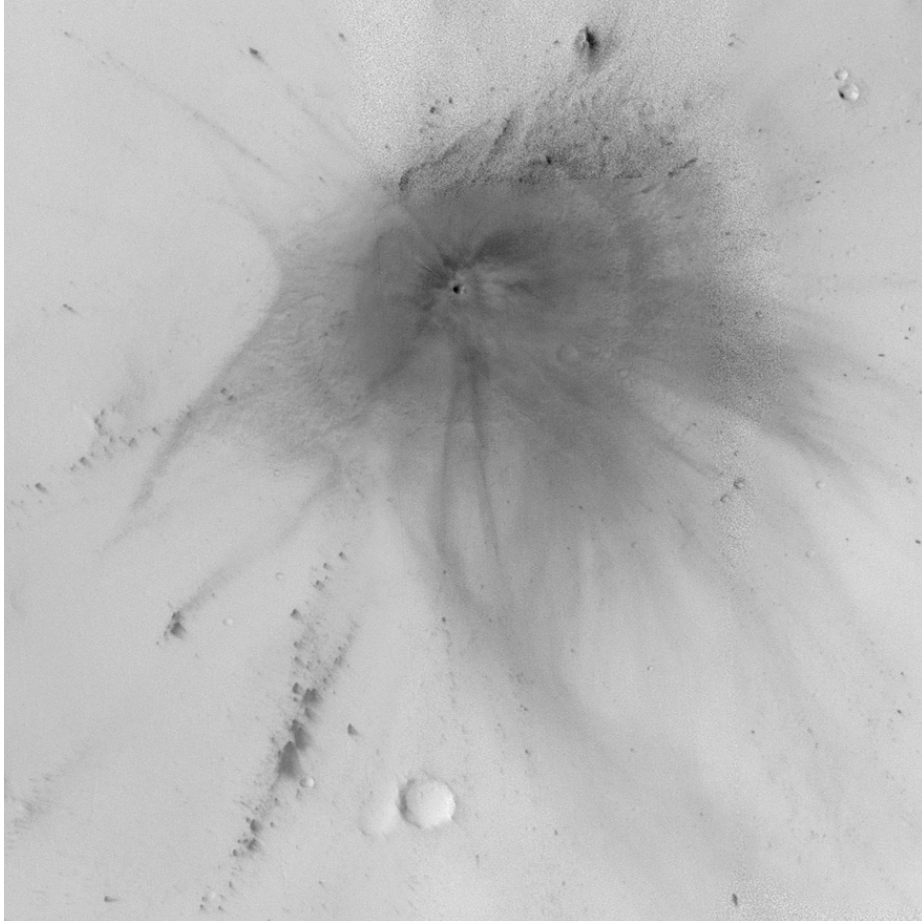


Catalog of New Impact Sites on Mars Formed May 1999 – March 2006



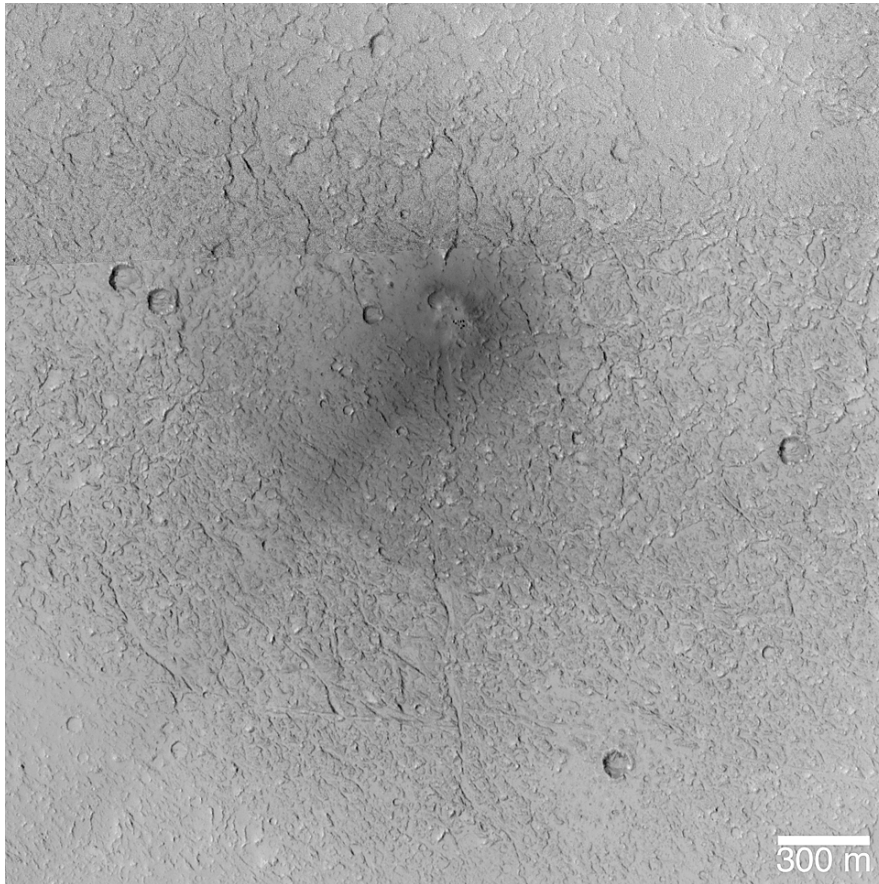
**Michael C. Malin, Kenneth S. Edgett, Liliya V. Posiolova,
Shawn M. McColley, and Eldar Z. Noe Dobrea
Malin Space Science Systems, Inc.
San Diego, California, USA**

October 2006

This catalog constitutes supporting material that accompanies a paper published in *Science* in late 2006 by M. C. Malin, *et al.*, regarding recent impact craters formed on the martian surface between May 1999 and March 2006. The reader should refer to that paper and its Supporting Online Material for additional details regarding the craters documented here.

This document is designed to be printed double-sided (one page on each side of each piece of paper).

Impact Site 1, 14.0°N, 151.5°W (page 1 of 3)



Composite of sub-frames of MOC images S15-02128 and S16-01426.
Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S15-02128 (ROTO, 20 February 2006)
- S16-01426 (cPROTO, 16 March 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S14-00672 (red wide angle, sample 131, line 295, 6 January 2006)

Most recent image before impact occurred:

- certain: THEMIS V12924012 (12 November 2004)
- uncertain owing to poor visibility: THEMIS I14771016 (13 April 2005)

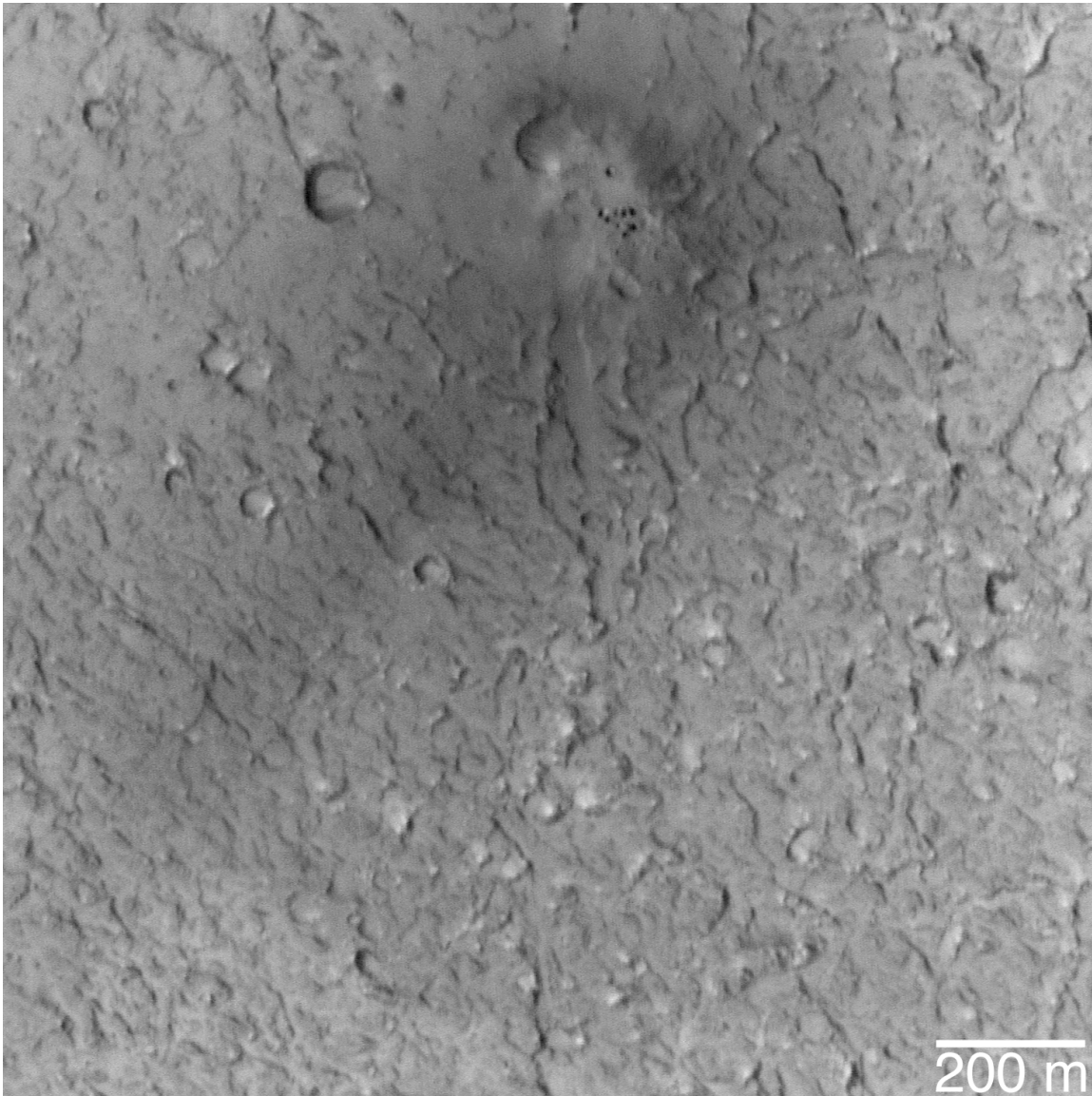
First image of impact site, after impact occurred:

- uncertain owing to poor visibility: THEMIS I14771016 (13 April 2005)
- certain: MOC S14-00672 (6 January 2006)

Dates that constrain when impact occurred:

- certain: 12 November 2004 – 6 January 2006
- uncertain: might have occurred before or after 13 April 2005

Impact Site 1, 14.0°N, 151.5°W (page 2 of 3)



Sub-frame of MOC cPROTO image S16-01426. Simple cylindrical projection; north is up.

Notes:

The impact site exhibits multiple craters, approximately 7 at $\sim 10 \text{ m} \pm 1.7 \text{ m}$ diameter. A singular crater of $11.0 \pm 1.7 \text{ m}$ diameter is offset to the north-northwest from a cluster of craters.

Impact Site 1, 14.0°N, 151.5°W (page 3 of 3)

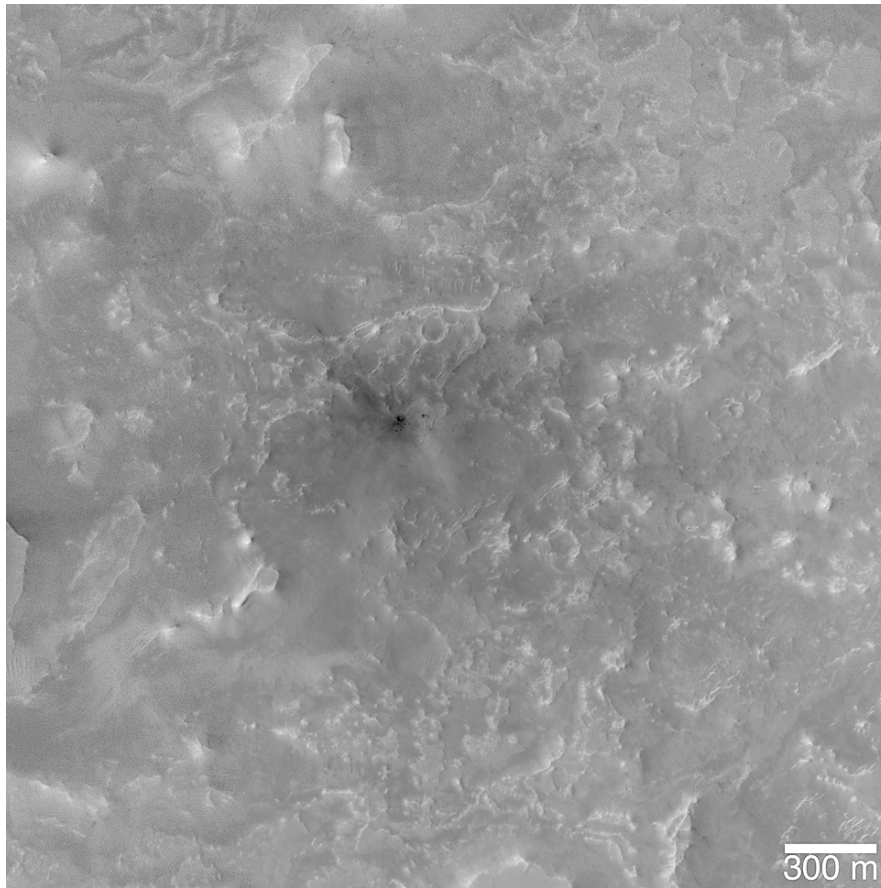


Before (left) and after (right) the impact. Left shows a sub-frame of THEMIS V12942012, acquired on 12 November 2004. Right shows same image, with MOC S15-02128, acquired 20 February 2006, superimposed. The impact is thought to have occurred sometime between November 2004 and January 2006, possibly after THEMIS I14771016 was obtained on 13 April 2005.

Simple cylindrical projection; north is up.

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Impact Site 2, 25.8°N, 308.0°W (page 1 of 4)



Composite of sub-frames of MOC images S15-02322 and S17-01393.
Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S15-02322 (ROTO, 22 February 2006)
- S17-01393 (cPROTO, 17 April 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S14-03311 (red wide angle, sample 347, line 6367, 31 January 2006)

Most recent image before impact occurred:

- THEMIS V17834021 (21 December 2005)

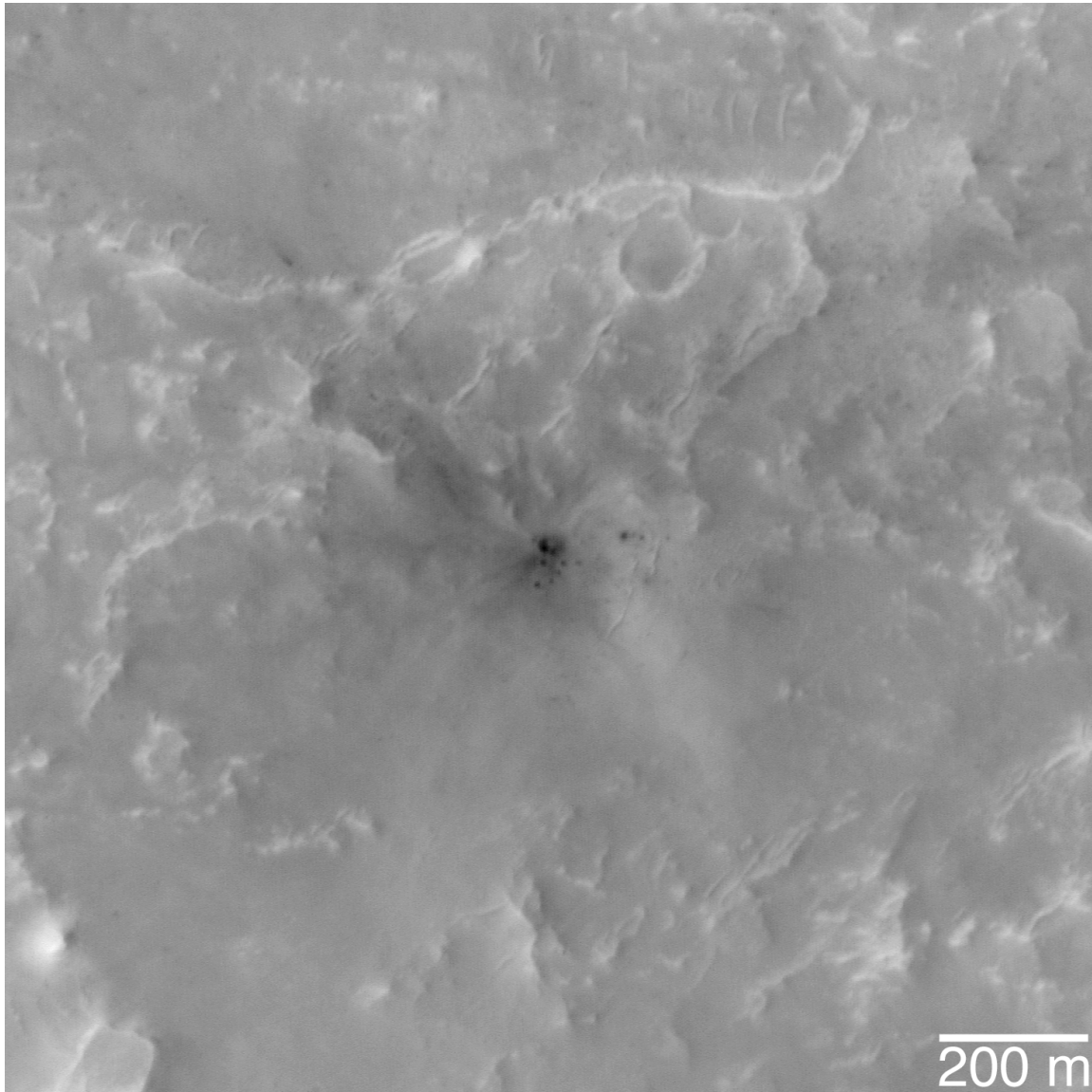
First image of impact site, after impact occurred:

- MOC S14-03311 (31 January 2006)

Dates that constrain when impact occurred:

- 21 December 2005 – 31 January 2006 (42-day interval)

Impact Site 2, 25.8°N, 308.0°W (page 2 of 4)



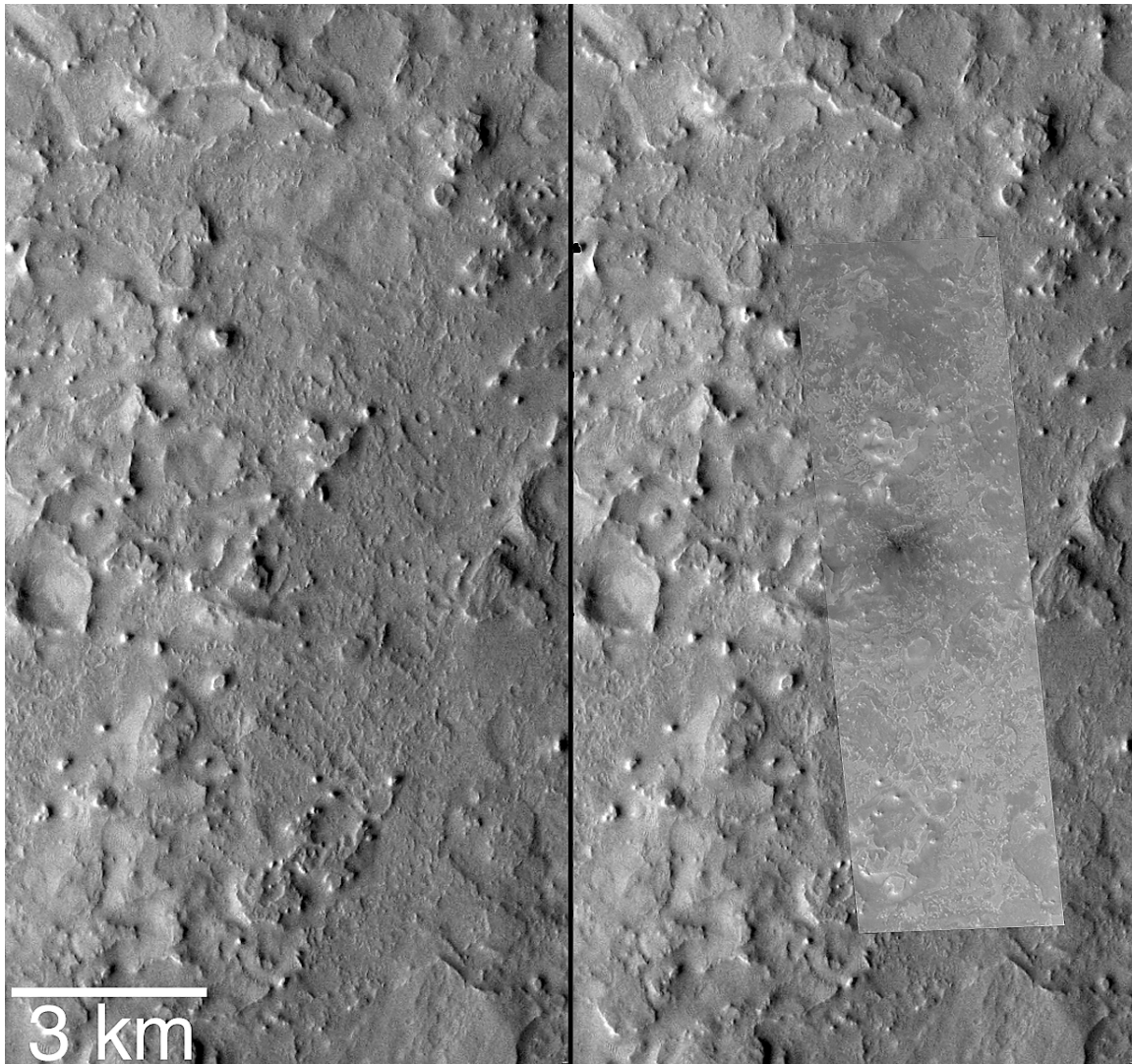
Sub-frame of MOC cPROTO image S17-01393. Simple cylindrical projection; north is up.

Notes:

This impact occurred between 21 December 2005 and 31 January 2006. Statistically, it is possible that this crater formed after 6 January 2006, which is when we first noticed a dark spot at Impact Site 1, which was the first indicator that we could find these fresh craters and document them.

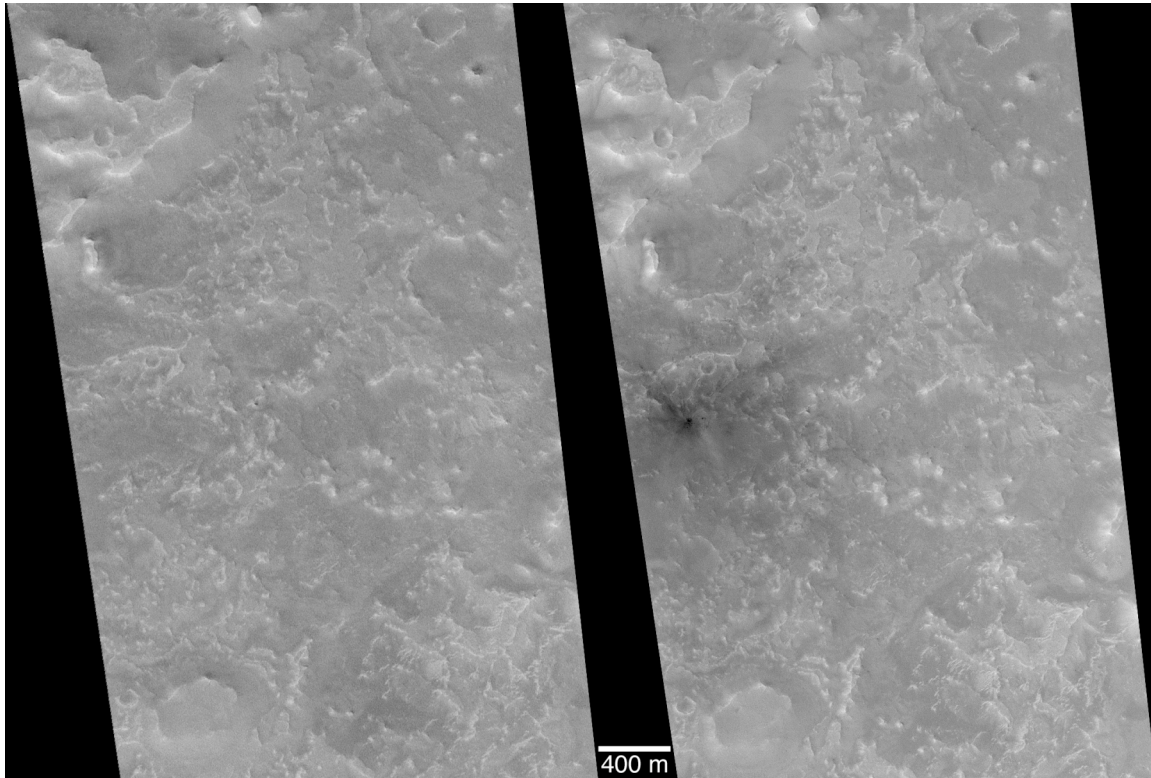
The impact site exhibits a single crater of 16.0 ± 1.7 m diameter, with several dark spots nearby to the south and east.

Impact Site 2, 25.8°N, 308.0°W (page 3 of 4)



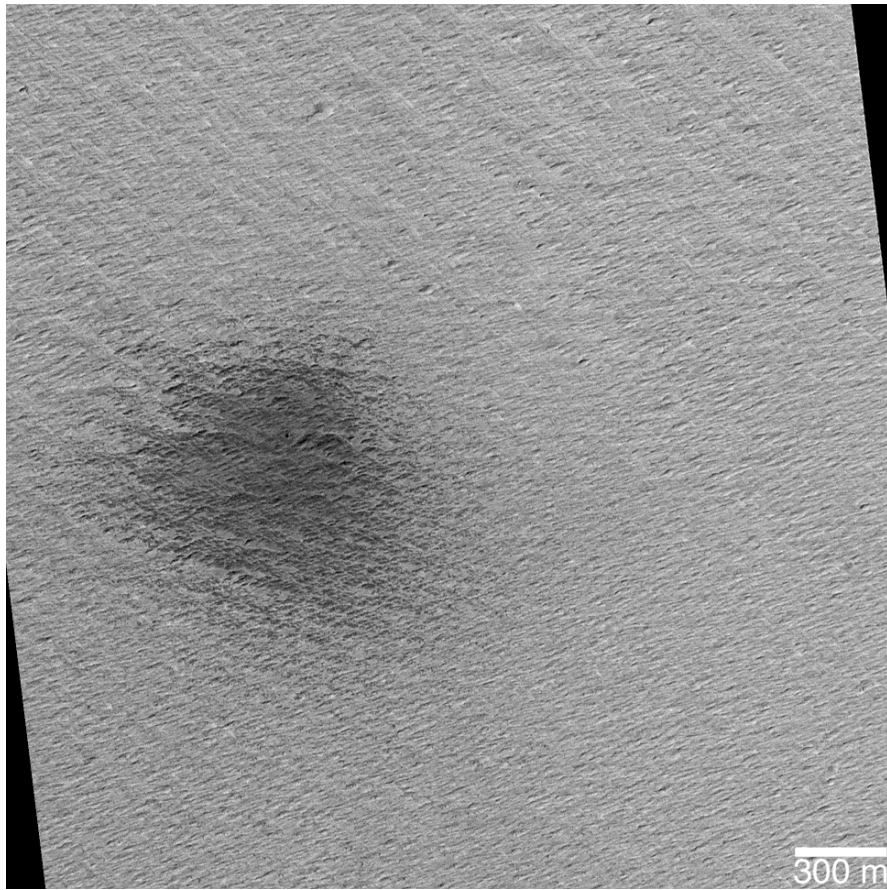
Before (left) and after (right) the impact. Left shows a sub-frame of THEMIS V17834021 (band 3), acquired on 21 December 2005. Right shows same image, with MOC S15-02322, acquired 22 February 2006, superimposed. The impact occurred between 21 December 2005 and 31 January 2006. Simple cylindrical projection; north is up.

Impact Site 2, 25.8°N, 308.0°W (page 4 of 4)



Before (left) and after (right) MOC narrow angle views of the impact site. Left shows a sub-frame of MOC R13-00039, acquired on 1 January 2004. Right shows a sub-frame of MOC S15-02322, acquired 22 February 2006, superimposed. From THEMIS V17834021, the impact is known to have occurred between 21 December 2005 and 31 January 2006. Simple cylindrical projection; north is up.

Impact Site 3, 0.8°S, 160.0°W (page 1 of 3)



Sub-frame of MOC image S15-02488. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S15-02488 (ROTO, 23 February 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S14-02683 (red wide angle, sample 443, line 957, 26 January 2006)

Most recent image before impact occurred:

- THEMIS I03951001 (4 November 2002)

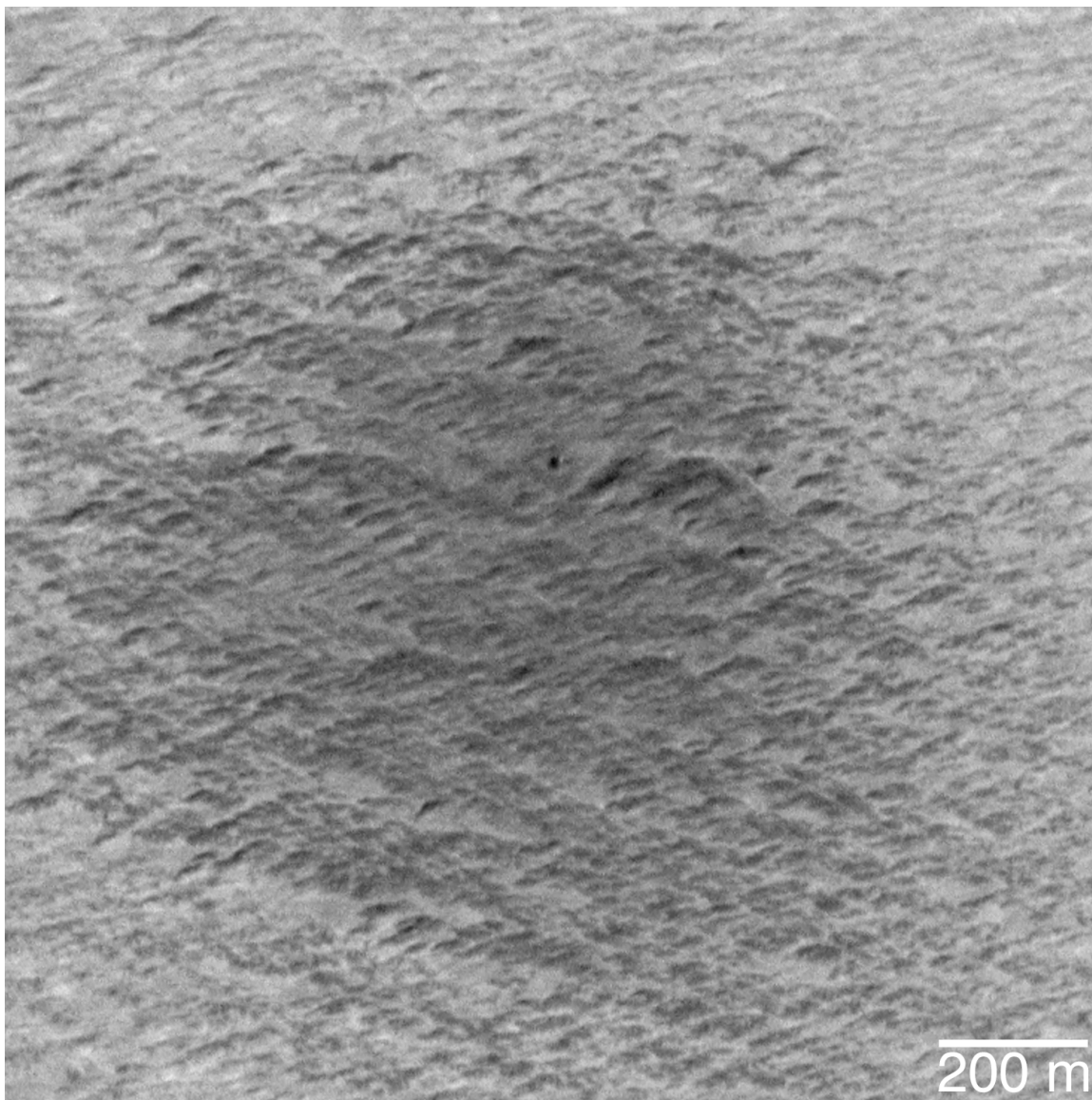
First image of impact site, after impact occurred:

- THEMIS I11228001 (25 June 2004)

Dates that constrain when impact occurred:

- 4 November 2002 – 25 June 2004

Impact Site 3, 0.8°S, 160.0°W (page 2 of 3)

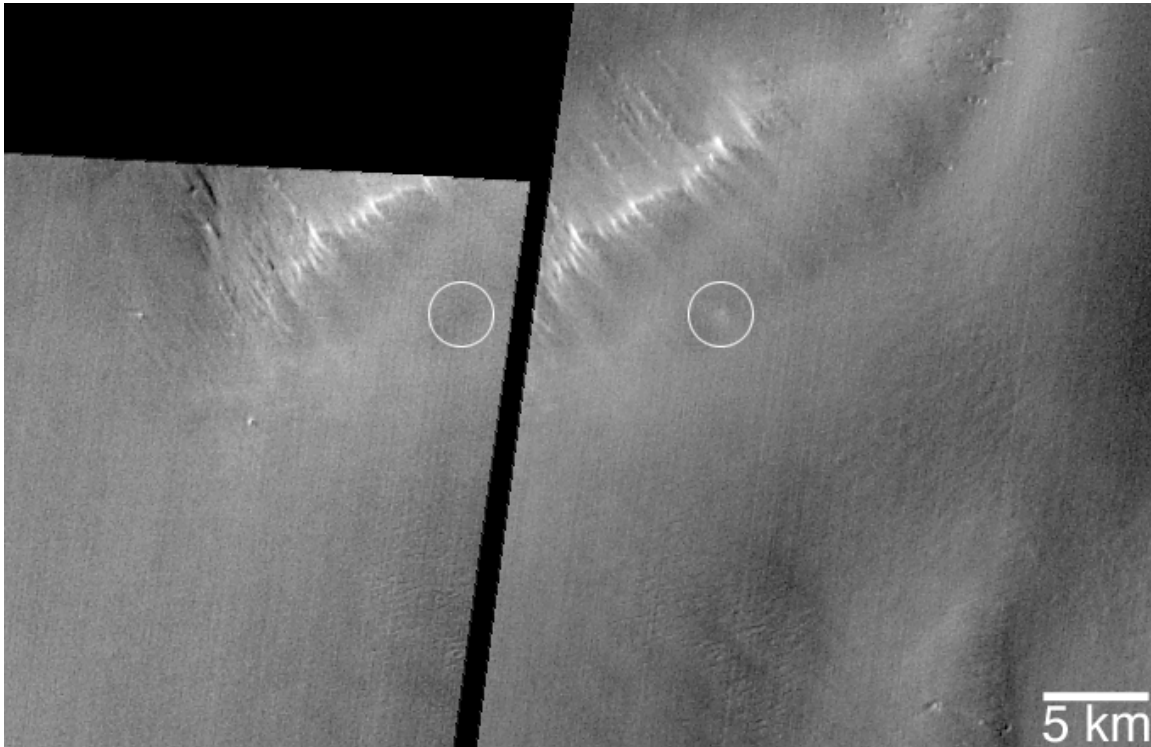


Sub-frame of MOC ROTO image S15-02488. Simple cylindrical projection; north is up.

Notes:

The impact site exhibits a single crater of 17.0 ± 3.0 m diameter.

Impact Site 3, 0.8°S, 160.0°W (page 3 of 3)



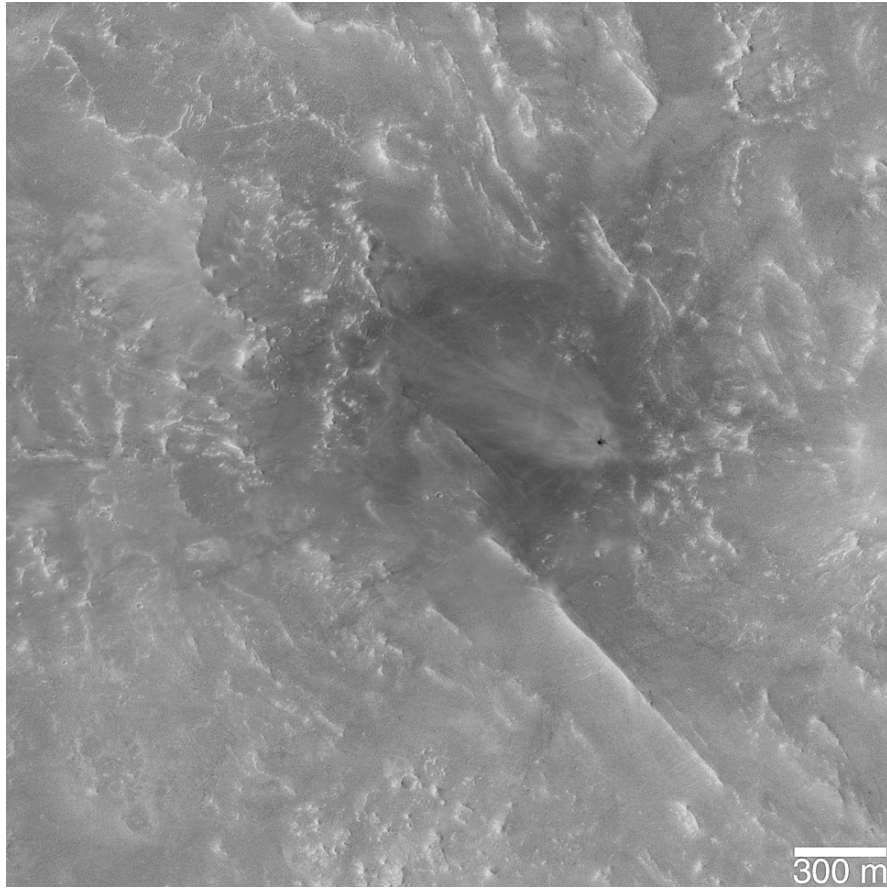
Before (left) and after (right) the impact. Left shows a sub-frame of THEMIS I03951001 (band 9), acquired on 4 November 2002. Right shows a sub-frame of THEMIS I11228001 (band 9), acquired 25 June 2004.

The white circle indicates the impact site, which is the bright spot at the center of the circle on the right.

Simple cylindrical projection; north is up.

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Impact Site 4, 23.3°N, 307.2°W (page 1 of 4)



Composite of sub-frames of MOC images S15-02522 and S16-01666.
Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S15-02522 (ROTO, 24 February 2006)
- S16-01666 (cPROTO, 20 March 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S14-03311 (red wide angle, sample 421, line 5738, 31 January 2006)

Most recent image before impact occurred:

- MOC E01-00237 (4 February 2001)

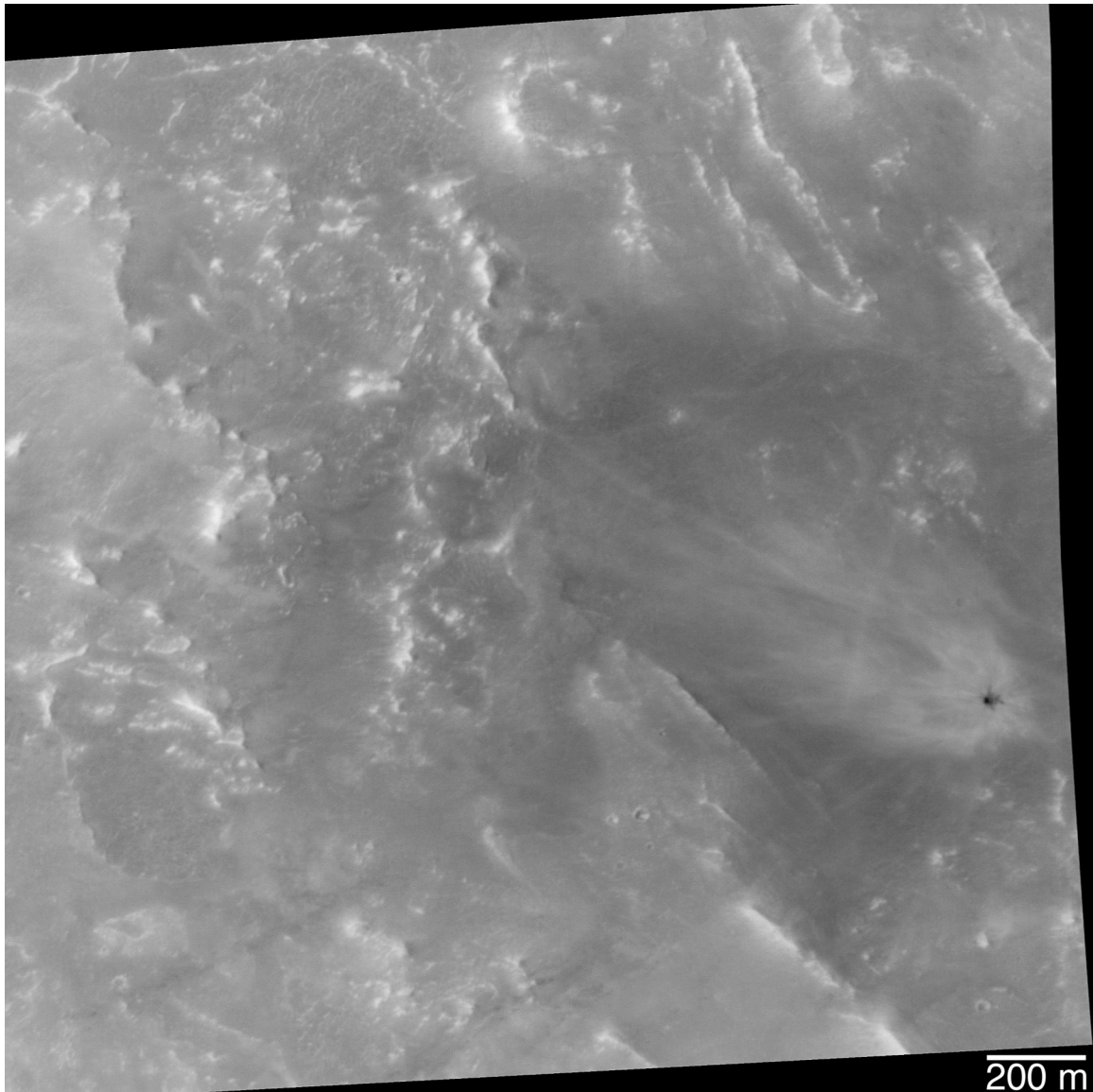
First image of impact site, after impact occurred:

- MOC S07-01349 (13 June 2005)

Dates that constrain when impact occurred:

- 4 February 2001 – 13 June 2005

Impact Site 4, 23.3°N, 307.2°W (page 2 of 4)

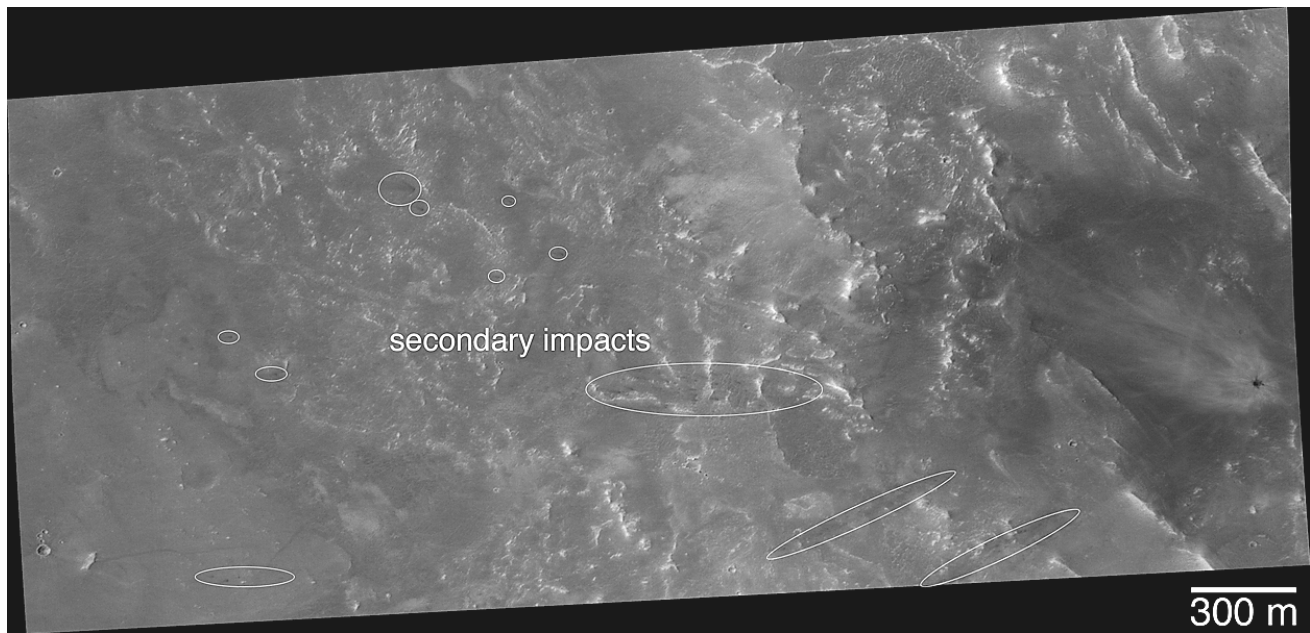


Sub-frame of MOC cPROTO image S16-01666, emphasizing the impact site; see following figure for view that includes secondary craters. Simple cylindrical projection; north is up.

Notes:

The impact site exhibits a single crater of 15.6 ± 1.7 m diameter. The cPROTO view shows nice multi-toned ejecta and displays secondary impacts some distance from the crater. As for constraining the time that the impact occurred, there is a THEMIS infrared image, I11669005 (1 August 2004), that post-dates the E01-00237 (4 February 2001) and shows no evidence of the impact—but—a similar THEMIS infrared image that was acquired after S07-01349 (13 June 2005), numbered I17809015 (19 December 2005), also shows no impact feature. Therefore, neither THEMIS infrared image was considered useful in constraining the date the impact occurred. The asymmetric distribution of ejecta suggests that the impactor came in from the east-southeast.

Impact Site 4, 23.3°N, 307.2°W (page 3 of 4)

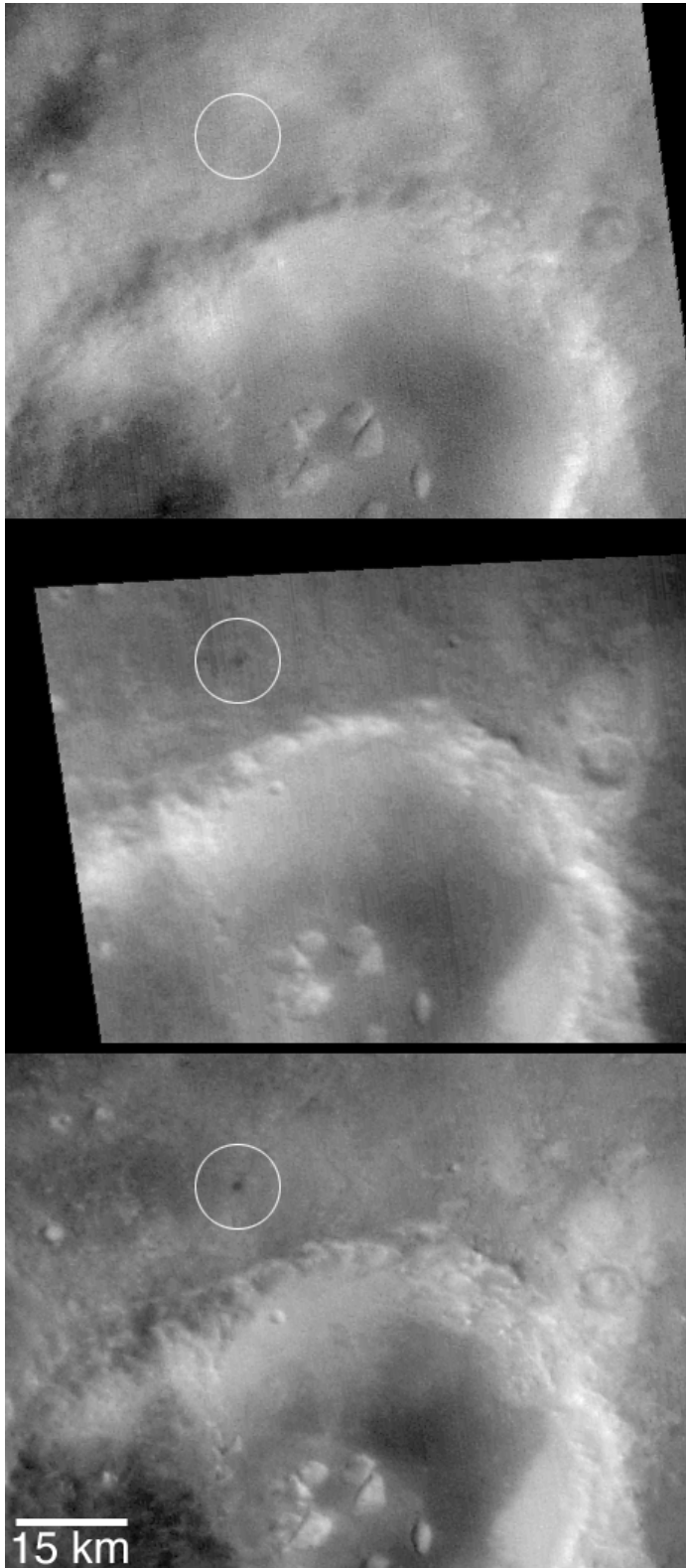


Entire MOC cPROTO image S16-01666, showing locations of secondary impacts from the primary, which is located at the far right. Simple cylindrical projection; north is up.



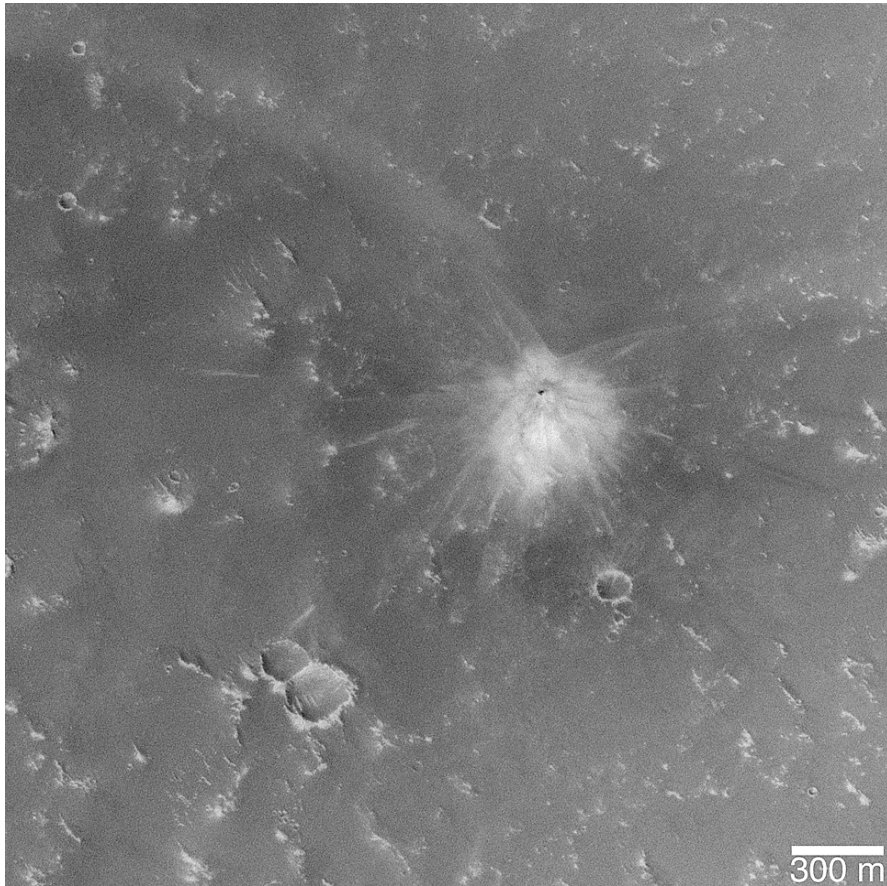
Portion of MOC cPROTO image S16-01666, emphasizing locations of some of the secondary impact locations. Simple cylindrical projection; north is up.

Impact Site 4, 23.3°N, 307.2°W (page 4 of 4)



Before and after views of impact site. The first picture (top) is a sub-frame of MOC red wide angle image E01-00237, acquired 4 February 2001. The second (middle) is a sub-frame of MOC red wide angle image S07-01349, obtained 13 June 2005. The third (bottom) is the MOC red wide angle context image acquired with the ROTO view of the crater on 24 February 2006; it is S15-02523. The white circle indicates the location of the impact site, which appears as a dark spot in the middle and lower images. The impact had not occurred when the first picture was obtained in 2001. The image projection is simple cylindrical; north is up.

Impact Site 5, 20.6°N, 356.8°W (page 1 of 3)



Sub-frame of MOC image S15-02724. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S15-02724 (ROTO, 26 February 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S15-00478 (red wide angle, sample 337, line 2280, 5 February 2006)

Most recent image before impact occurred:

- THEMIS I02409005 (30 June 2002)

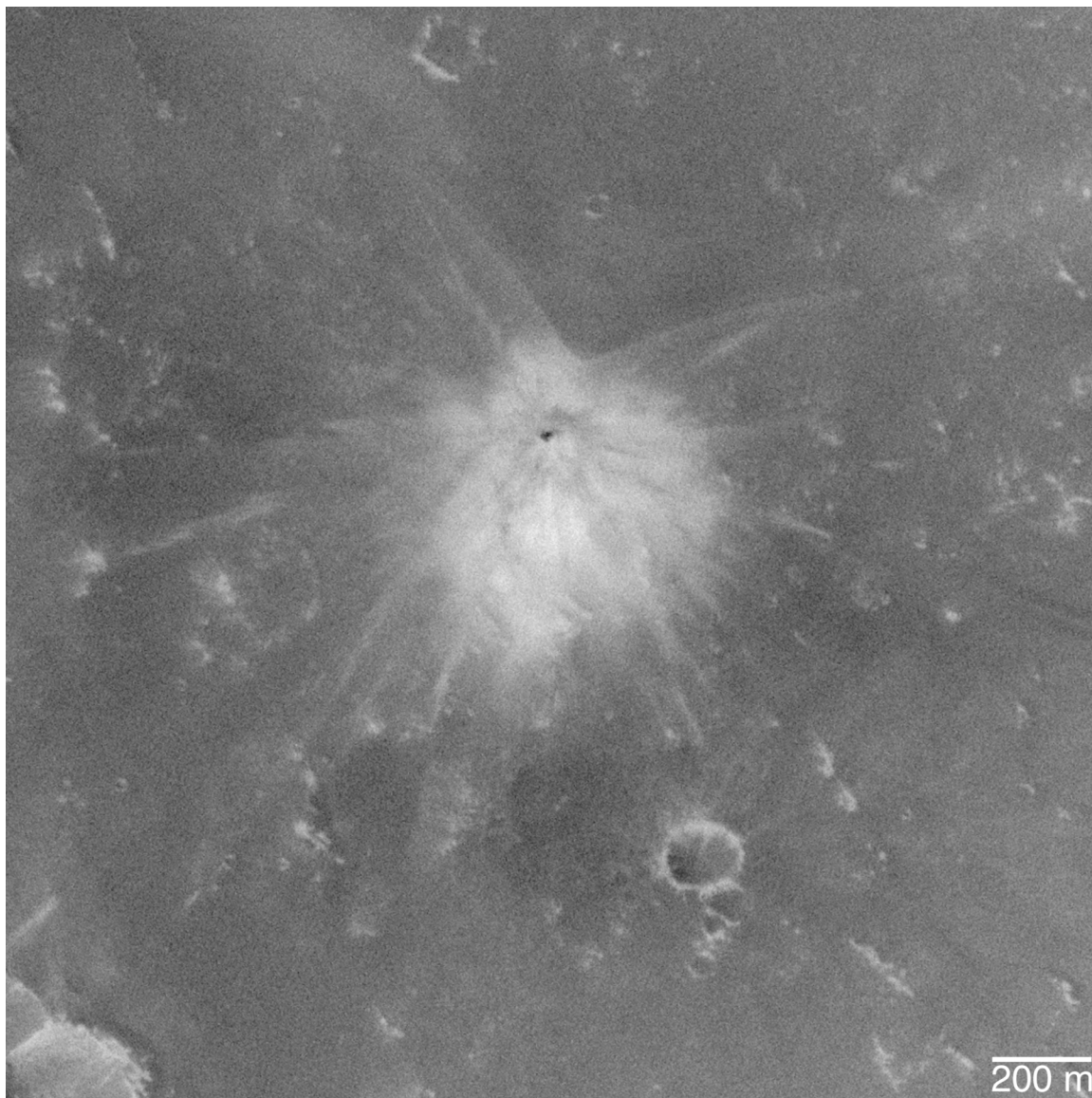
First image of impact site, after impact occurred:

- MOC R05-00630 (7 May 2003)

Dates that constrain when impact occurred:

- 30 June 2002 – 7 May 2003

Impact Site 5, 20.6°N, 356.8°W (page 2 of 3)

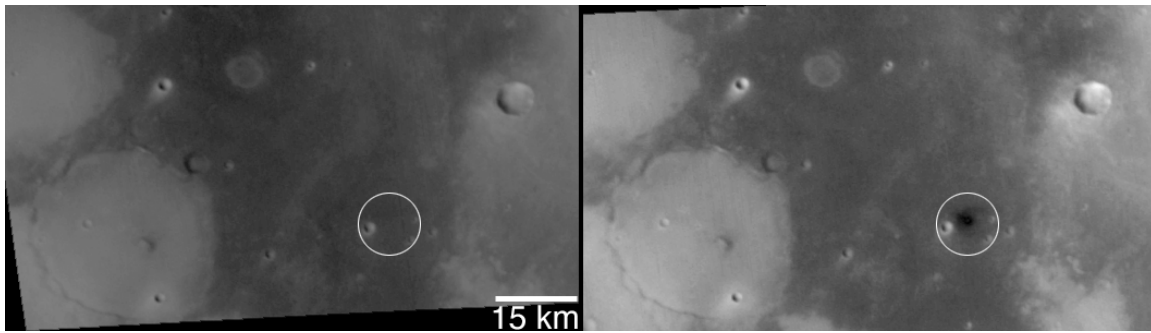


Sub-frame of MOC ROTO image S15-02724. Simple cylindrical projection; north is up.

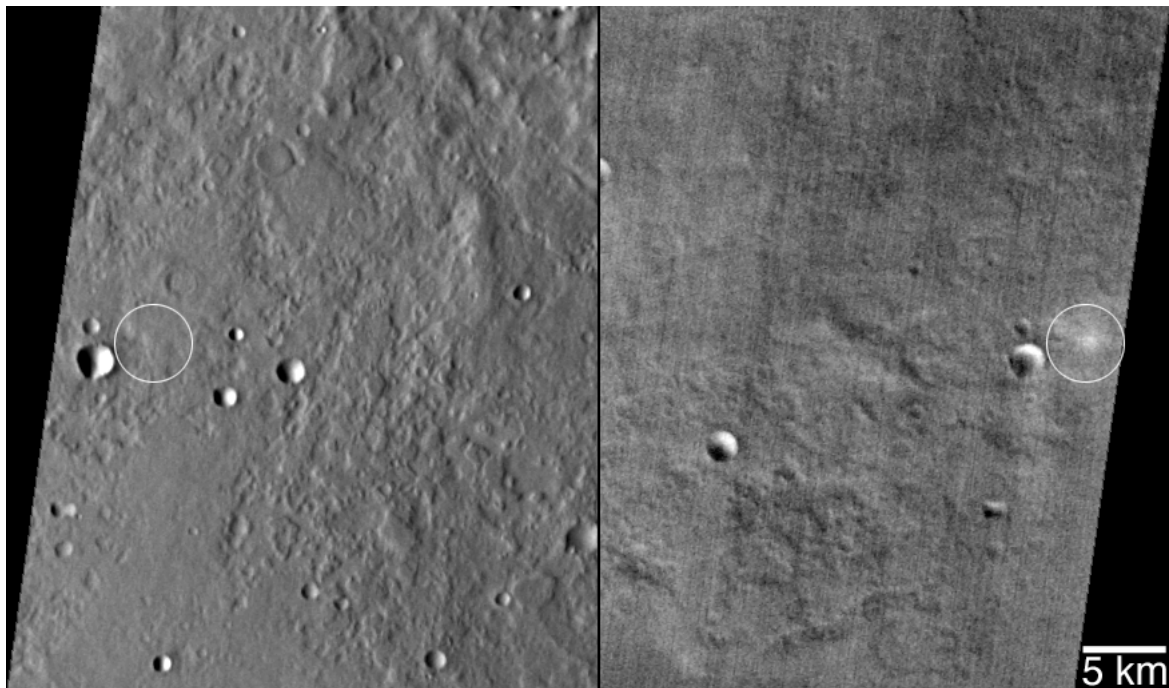
Notes:

The impact site exhibits a single crater of 22.6 ± 3.0 m diameter.

Impact Site 5, 20.6°N, 356.8°W (page 3 of 3)



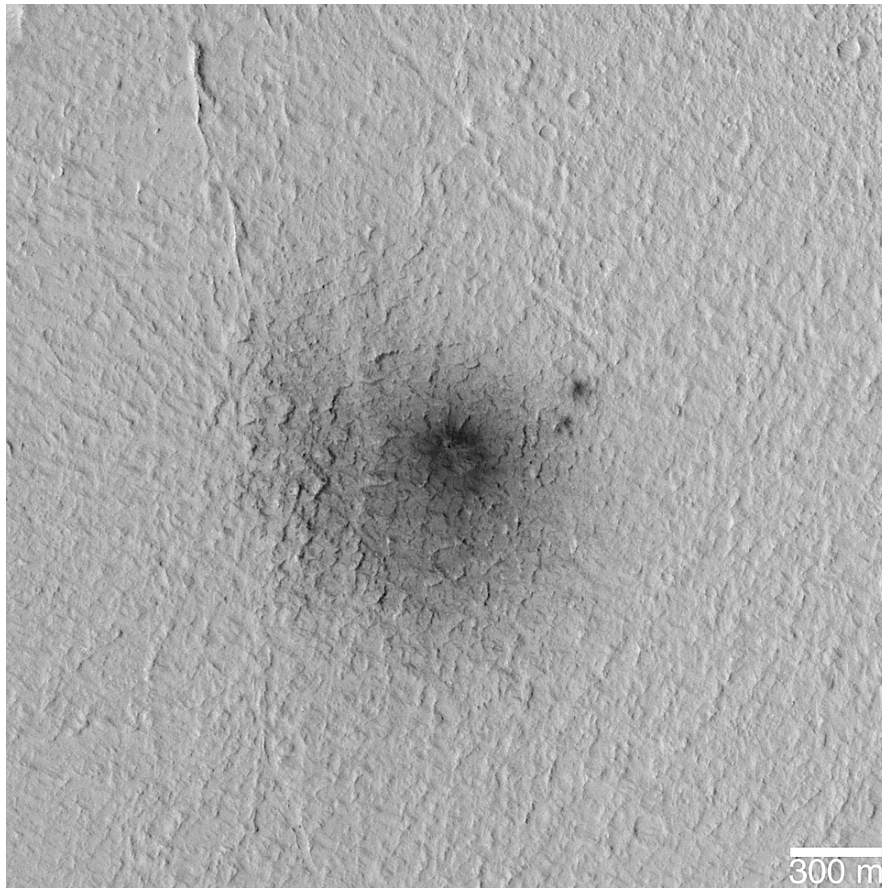
MOC red wide angle camera view of impact site, before (left) and after (right). On the left is a sub-frame of MOC red wide angle image M04-04229 (31 August 1999); on the right is a sub-frame of MOC red wide angle image R05-00630 (7 May 2003). The image on the right, along with the THEMIS infrared image described below, helps constrain the date of the impact (between 30 June 2002 and 7 May 2003). The white circle indicates the location of the impact site, which appears dark in the image on the right. Simple cylindrical projection; north is up.



THEMIS daytime infrared (band 9) views of impact site, before (left) and after (right). On the left is a sub-frame of I02409005 (band 9; 30 June 2002); on the right is a sub-frame of I08014019 (band 9; 5 October 2003). The image on the right, along with the MOC described above, helps constrain the date of the impact (between 30 June 2002 and 7 May 2003). Simple cylindrical projection; north is up.

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Impact Site 6, 20.0°N, 152.7°W (page 1 of 3)



Sub-frame of MOC image S16-00097. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S16-00097 (ROTO, 2 March 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S15-01354 (red wide angle, sample 542, line 3246, 13 February 2006)

Most recent image before impact occurred:

- THEMIS I17267007 (5 November 2005)

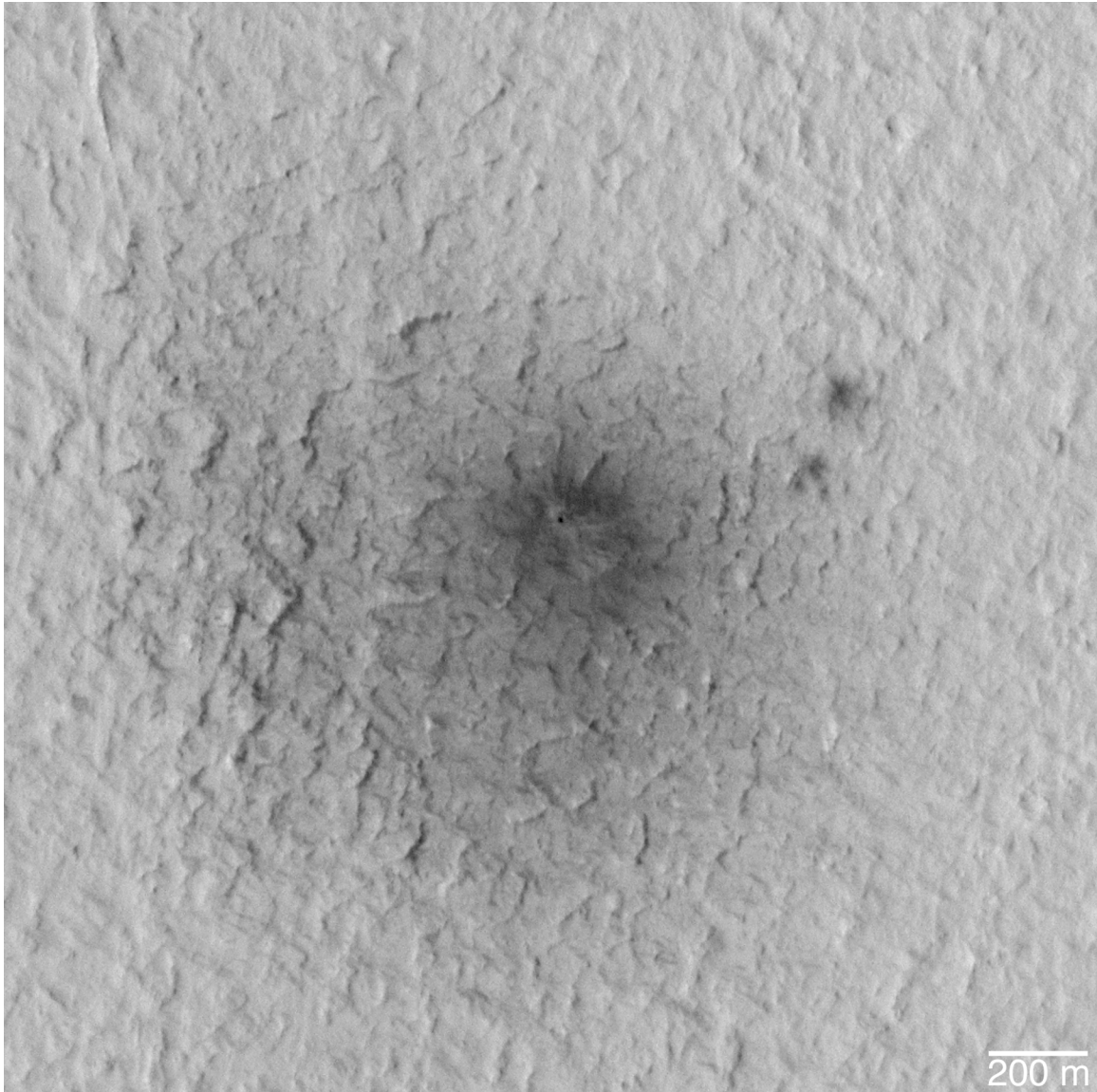
First image of impact site, after impact occurred:

- MOC S15-01354 (13 February 2006)

Dates that constrain when impact occurred:

- 5 November 2005 – 13 February 2006

Impact Site 6, 20.0°N, 152.7°W (page 2 of 3)



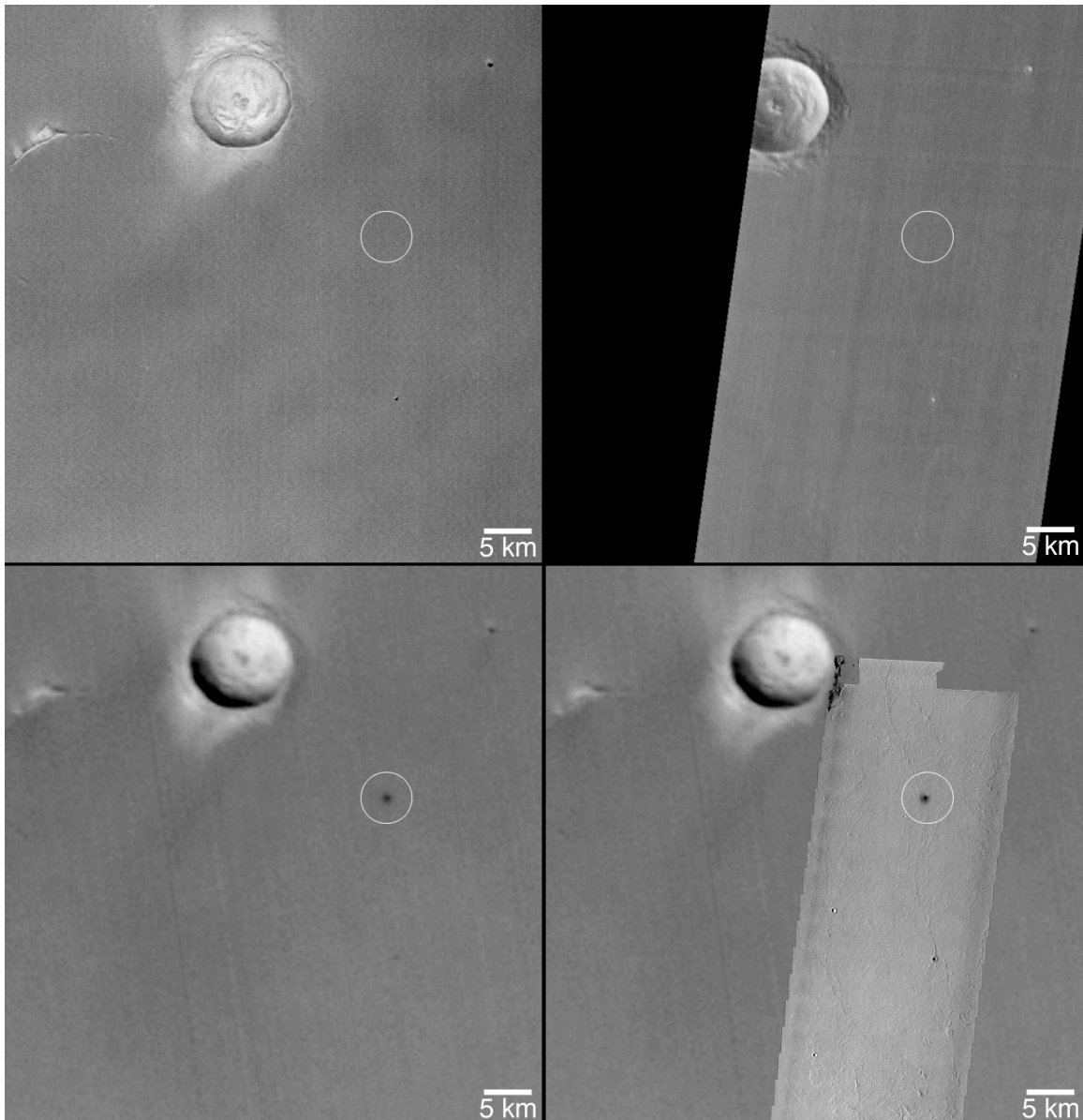
Sub-frame of MOC ROTO image S16-0097. Simple cylindrical projection; north is up.

Notes:

The impact site exhibits a single crater of 12.6 ± 3.0 m diameter.

THEMIS V19114010, acquired 6 April 2006, also shows this impact site.

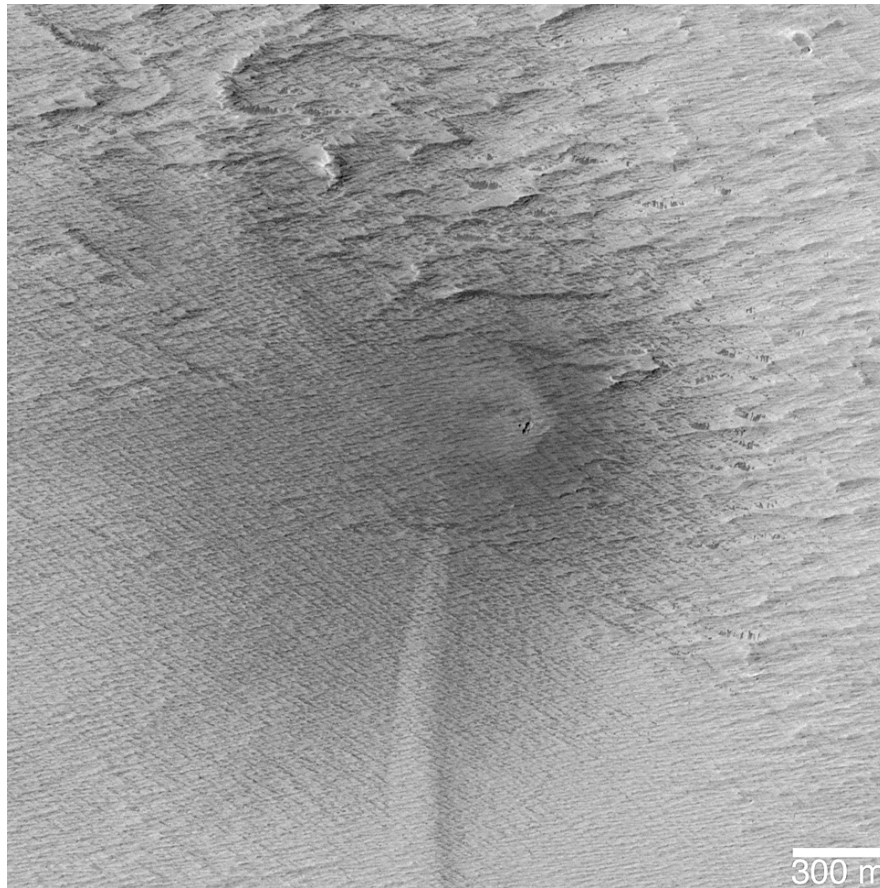
Impact Site 6, 20.0°N, 152.7°W (page 3 of 3)



Orbiter images showing the site before and after the impact; the white circle denotes the impact location. The top two views were acquired in 2005, before the impact occurred. At top left is a sub-frame of HRSC image H1331_0000_ND3 (30 January 2005); top right is a sub-frame of THEMIS I17267007 (band 9; 5 November 2005). At the bottom are two images obtained after the impact occurred. At lower left is a sub-frame of MOC red wide angle image S15-01354 (13 February 2006), the first image in which this feature was identified. At the lower right is THEMIS V19114010 (band 3; 6 April 2006), superimposed on MOC S15-01354 for context. The impact occurred some time between 5 November 2005 and 13 February 2006. Each image is a simple cylindrical projection; north is up.

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Impact Site 7, 0.03°S, 133.2°W (page 1 of 3)



Sub-frame of MOC image S16-02226. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S16-00667 (ROTO, 8 March 2006)
- S16-02226 (ROTO, 26 March 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S15-01464 (red wide angle, sample 894, line 1573, 14 February 2006)

Most recent image before impact occurred:

- THEMIS I10652014 (9 May 2004)

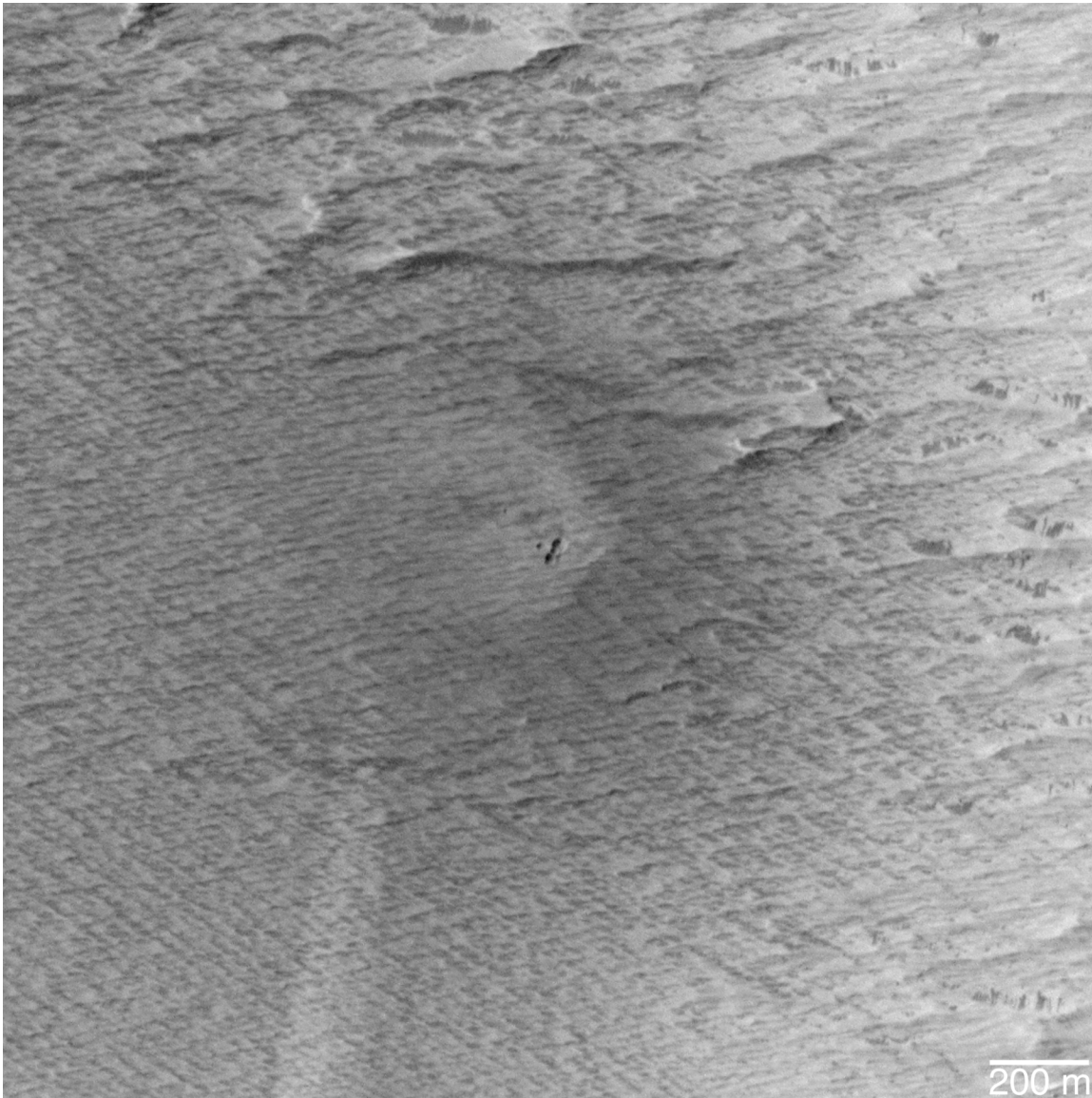
First image of impact site, after impact occurred:

- MOC S15-01463 (17 February 2006)

Dates that constrain when impact occurred:

- 9 May 2004 – 17 February 2006

Impact Site 7, 0.03°S, 133.2°W (page 2 of 3)



Sub-frame of MOC ROTO image S16-02226. Simple cylindrical projection; north is up.

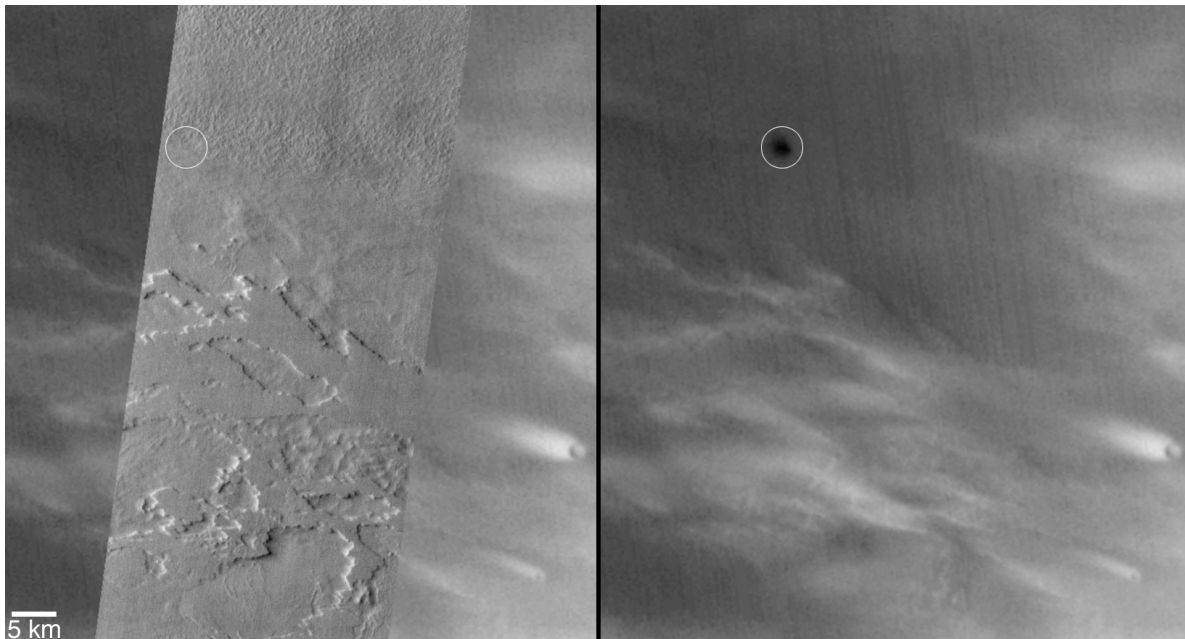
Notes:

The impact site exhibits 4 craters (3 adjoined and 1 separate from the group). The diameters are 22.4 ± 3.0 m, 15.4 ± 3.0 m, 12.6 ± 3.0 m, and 12.6 ± 3.0 m.

The atmosphere at the time that MOC ROTO image S16-00667 (8 March 2006) was obtained was hazy and the impact site was not as clearly seen as in S16-02226 (26 March 2006).

The dark spot/crater was not present in HRSC image H0037_0000_ND3 (21 January 2004), which was obtained a few months before THEMIS I10652014 (9 May 2004).

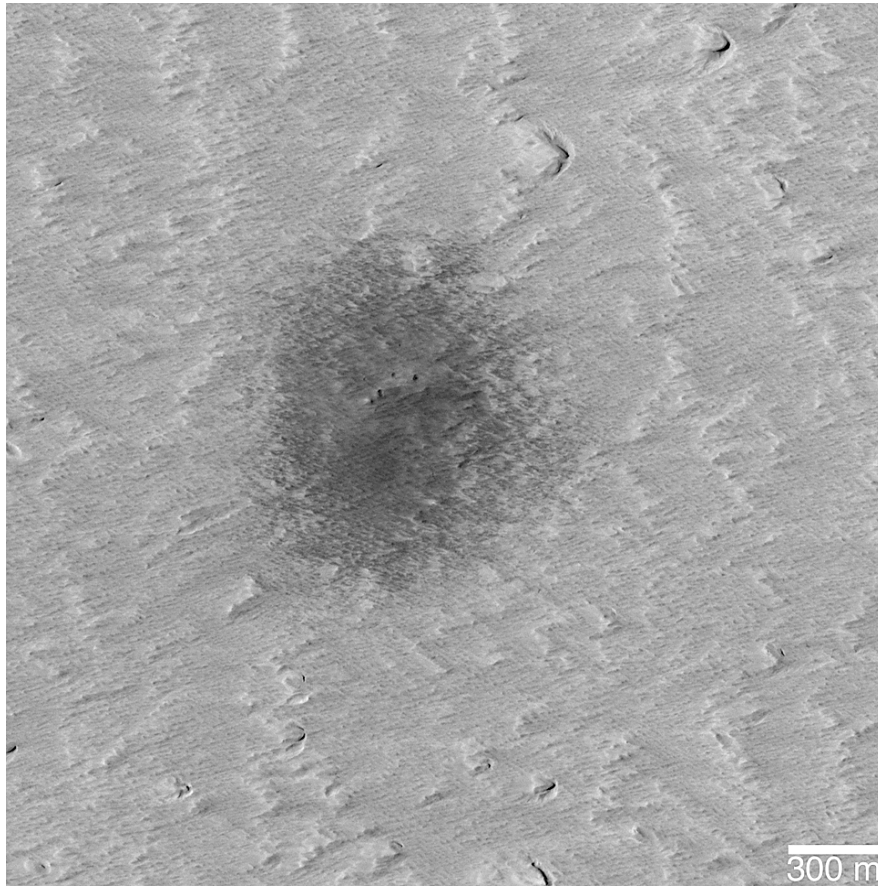
Impact Site 7, 0.03°S, 133.2°W (page 3 of 3)



Orbiter images showing the site before and after the impact; the white circle denotes the impact location. On the right is a sub-frame of THEMIS daytime infrared image I10652014 (band 9; 9 May 2004) superimposed on the lower-resolution MOC red wide angle image S15-01463 (17 February 2006) for context. On the right is the sub-frame of S15-01463; the dark spot indicates the impact site. In the THEMIS infrared image, if the impact had occurred before the data were acquired, a bright spot (thermally warm) would be visible. Each image is a simple cylindrical projection; north is up.

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Impact Site 8, 2.5°N, 136.0°W (page 1 of 3)



Sub-frame of MOC image S16-00855. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S16-00855 (ROTO, 10 March 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S15-01463 (red wide angle, sample 330, line 2240, 14 February 2006)

Most recent image before impact occurred:

- THEMIS I10103010 (25 March 2004)

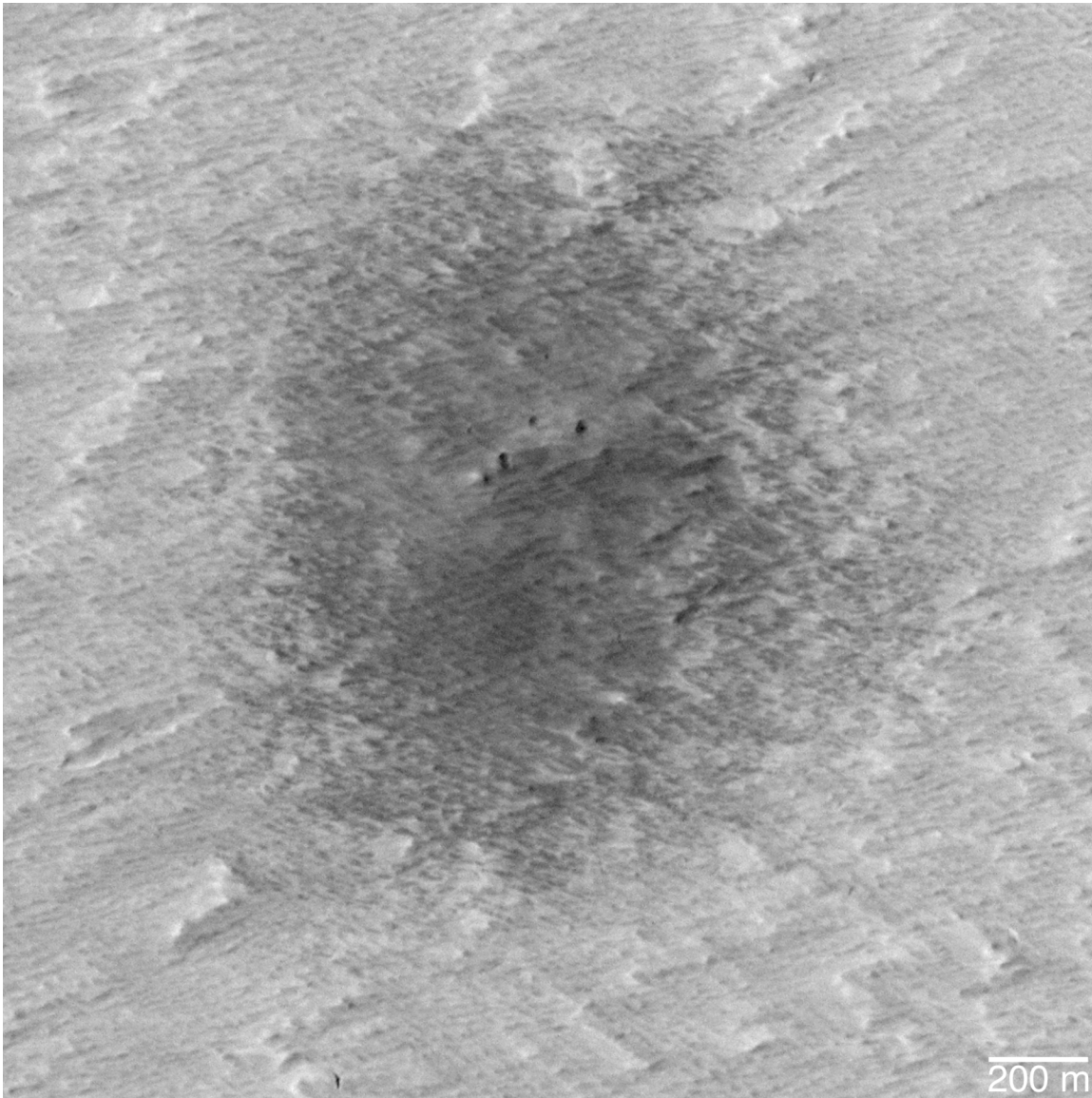
First image of impact site, after impact occurred:

- THEMIS I10727005 (15 May 2004)

Dates that constrain when impact occurred:

- 25 March 2004 – 15 May 2004 (51-day interval)

Impact Site 8, 2.5°N, 136.0°W (page 2 of 3)



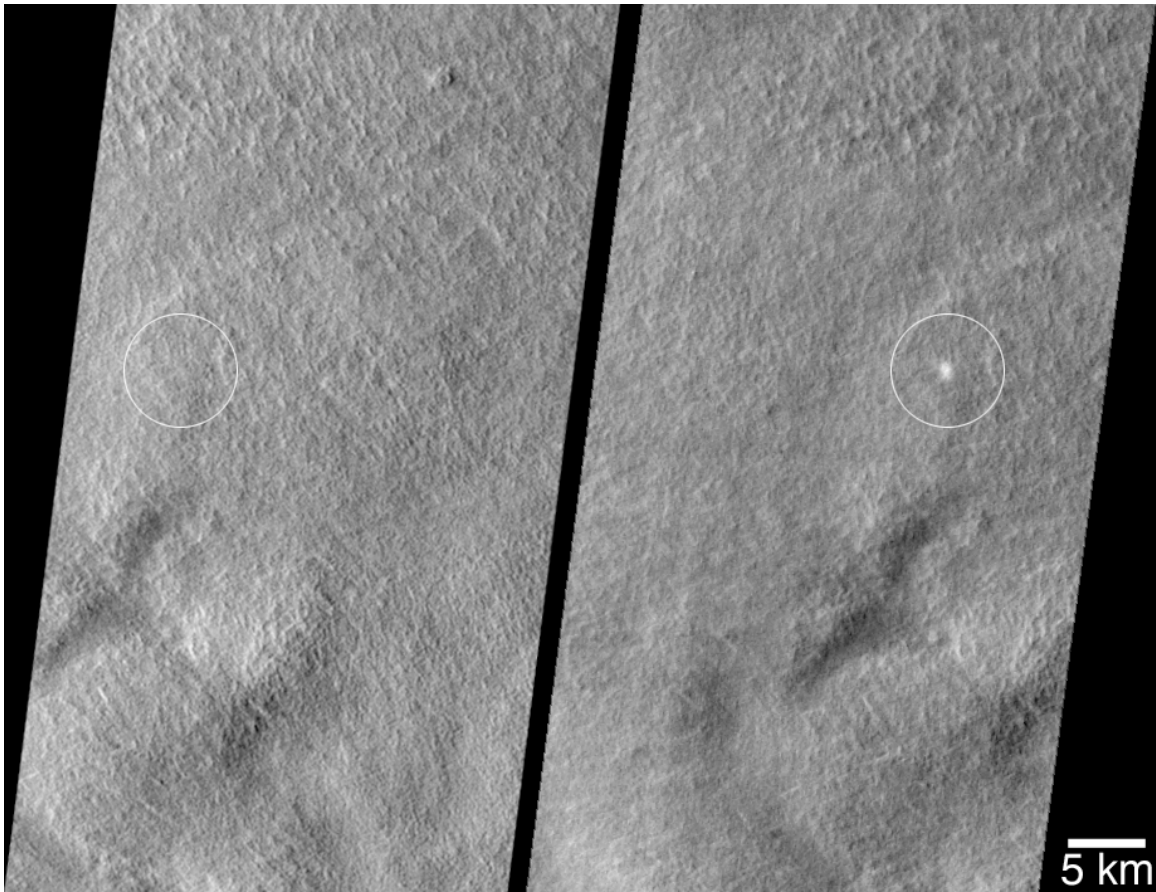
Sub-frame of MOC ROTO image S16-00855. Simple cylindrical projection; north is up.

Notes:

The impact site exhibits 4 craters with diameters of 29.6 ± 3 m, 21.6 ± 3 m, 19.6 ± 3 m, and 18.2 ± 3 m.

The fresh impact was also seen in THEMIS V15020008 (4 May 2005).

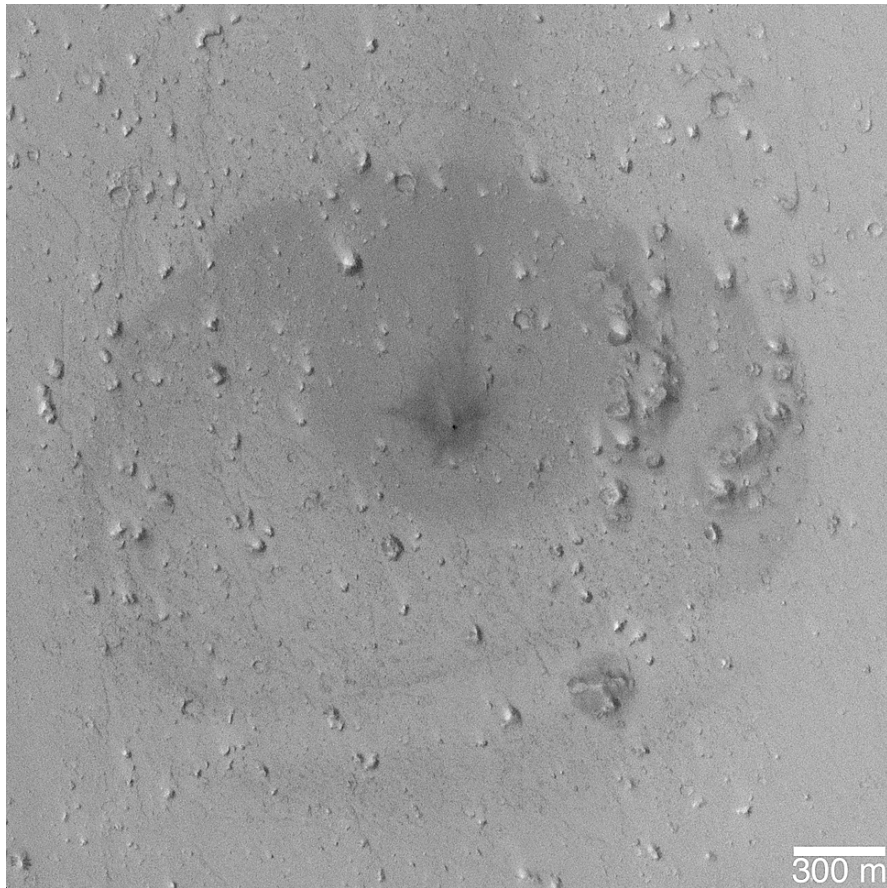
Impact Site 8, 2.5°N, 136.0°W (page 3 of 3)



Orbiter images showing the site before and after the impact; the white circle denotes the location. On the left is a sub-frame of THEMIS I10103010 (band 9; 25 March 2004); on right is a sub-frame of THEMIS I10727005 (band 9; 15 May 2004). A thermally warm (bright) spot appeared as a result of the impact. Each image is a simple cylindrical projection; north is up.

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Impact Site 9, 11.5°N, 156.6°W (page 1 of 3)



Sub-frame of MOC image S16-01063. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S16-01063 (ROTO, 12 March 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S15-00190 (red wide angle, sample 1540, line 1295, 2 February 2006)

Most recent image before impact occurred:

- MOC E13-00919 (11 February 2002)

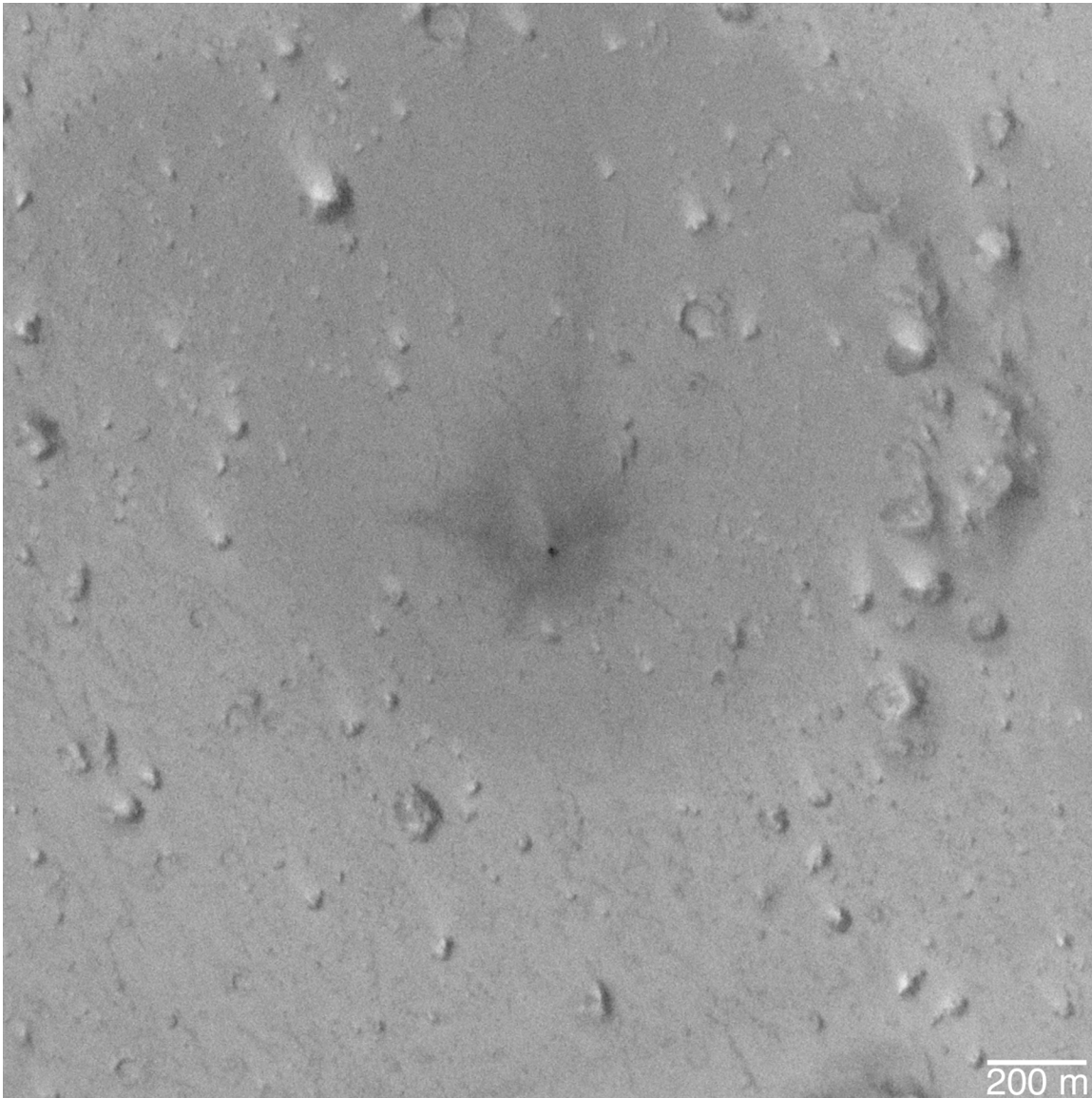
First image of impact site, after impact occurred:

- THEMIS I07645020 (4 September 2003)

Dates that constrain when impact occurred:

- 11 February 2002 – 4 September 2003

Impact Site 9, 11.5°N, 156.6°W (page 2 of 3)



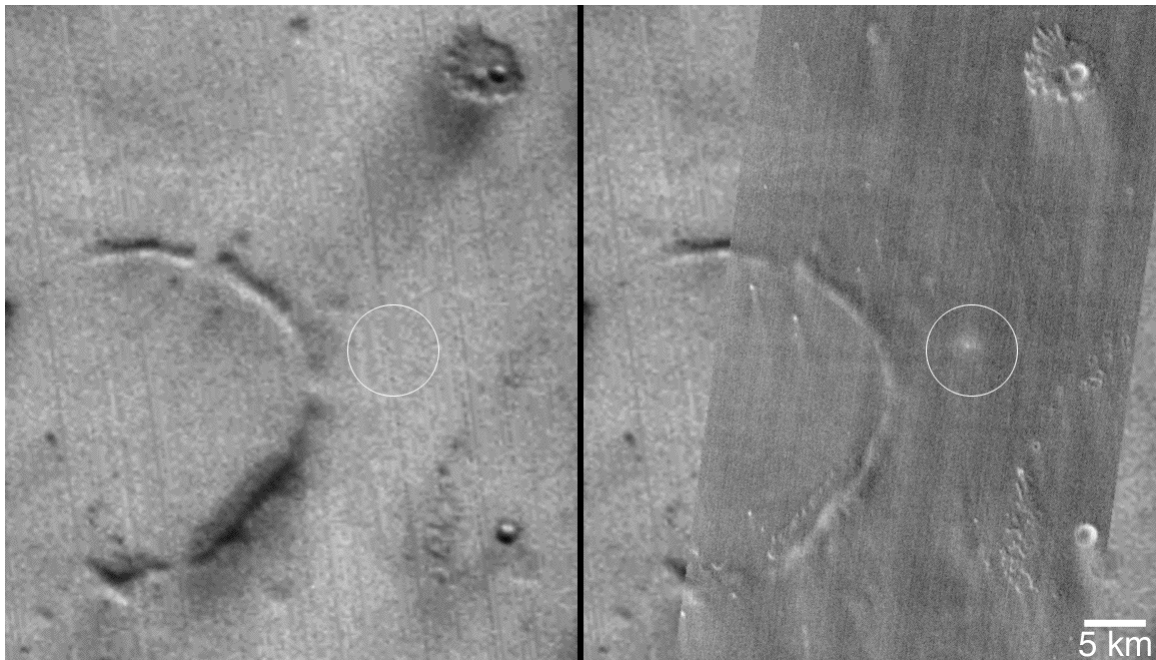
Sub-frame of MOC ROTO image S16-01063. Simple cylindrical projection; north is up.

Notes:

The impact site is a single crater with a 11.2 ± 3.0 m diameter.

The fresh impact site was also seen in THEMIS V09954010 (13 March 2004) and THEMIS V14871023 (21 April 2005).

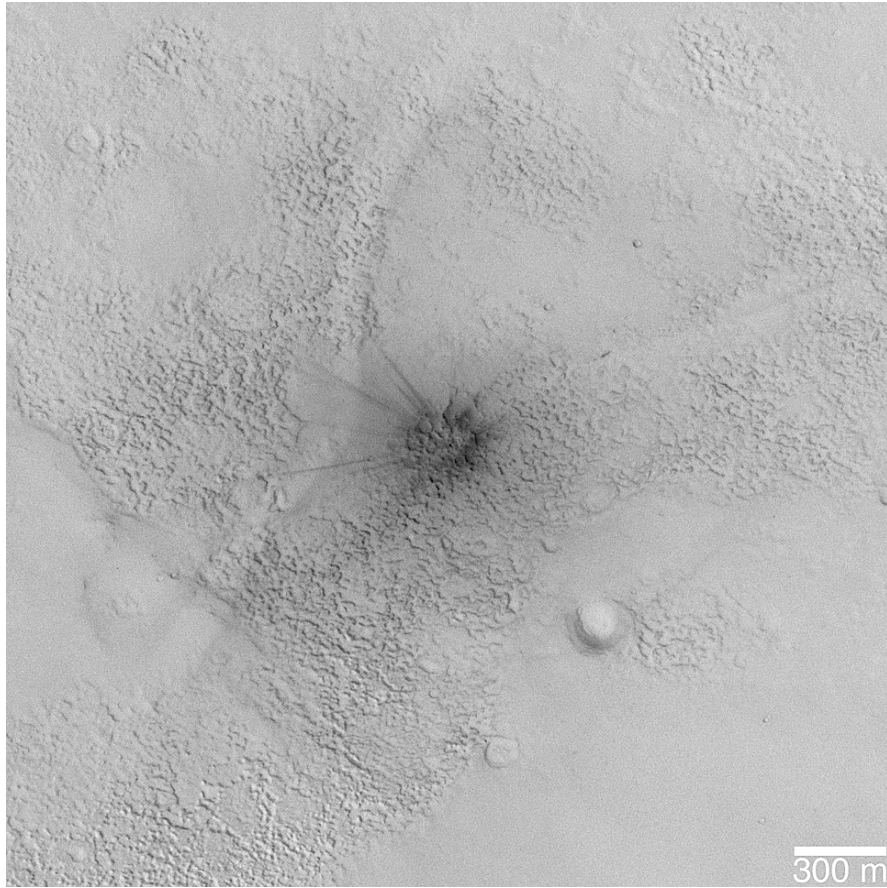
Impact Site 9, 11.5°N, 156.6°W (page 3 of 3)



Orbiter images showing the site before and after the impact; the white circle denotes the impact location. On the left is a sub-frame of MOC red wide angle image E13-00919 (11 February 2002). On the right is a sub-frame of THEMIS daytime infrared image I07645020 (band 9; 4 September 2003) overlain on the image, E13-00919. The fresh impact site appears thermally warm (bright) in the infrared view. Each image is a simple cylindrical projection; north is up.

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Impact Site 10, 29.3°N, 333.2°W (page 1 of 3)



Sub-frame of MOC image S16-01105. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S16-01105 (ROTO, 12 March 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S14-02741 (red wide angle, sample 170, line 3223, 26 January 2006)

Most recent image before impact occurred:

- MOC R05-00427 (5 May 2003)

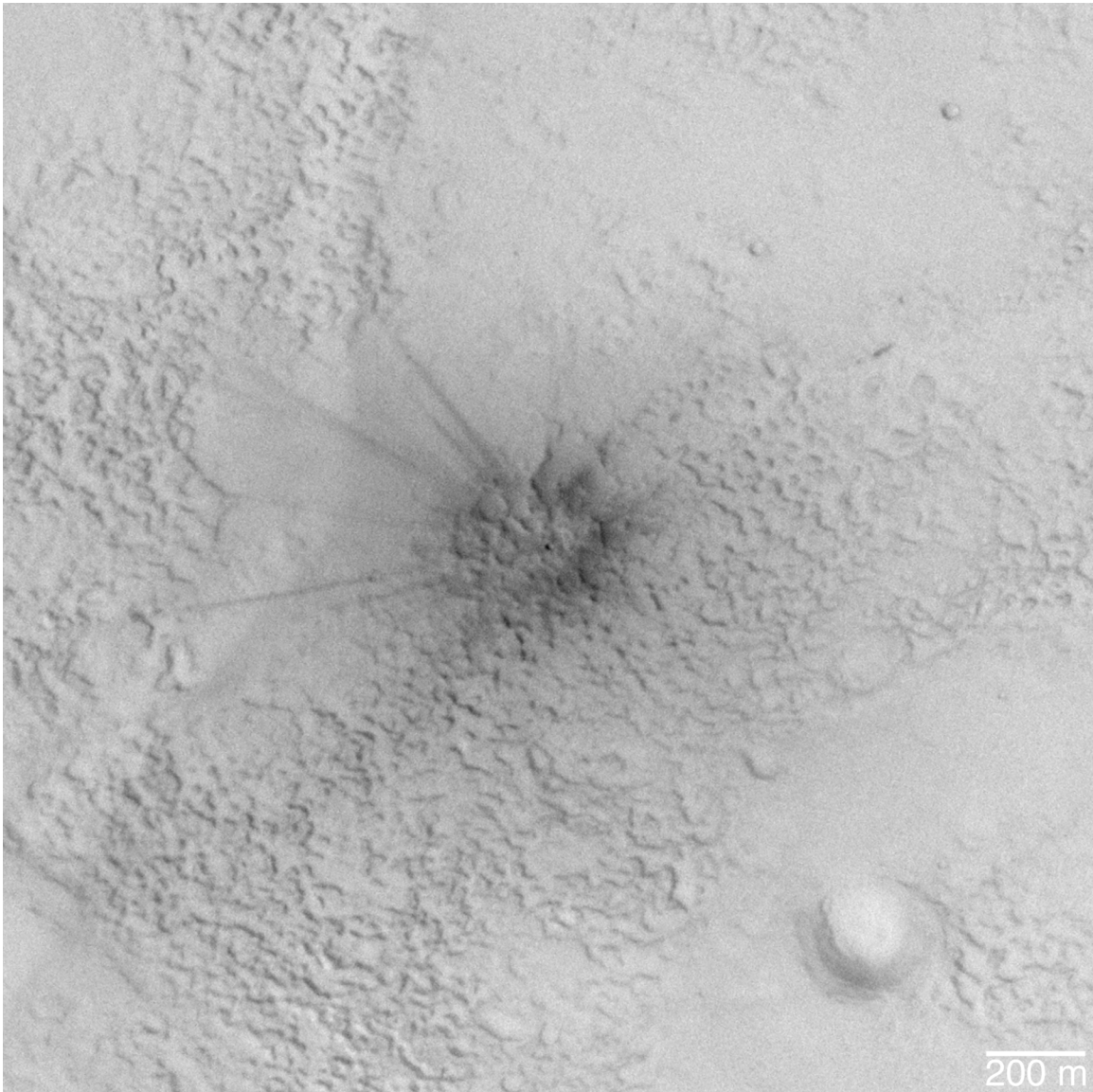
First image of impact site, after impact occurred:

- MOC S05-01885 (29 April 2005)

Dates that constrain when impact occurred:

- 5 May 2003 – 29 April 2005

Impact Site 10, 29.3°N, 333.2°W (page 2 of 3)



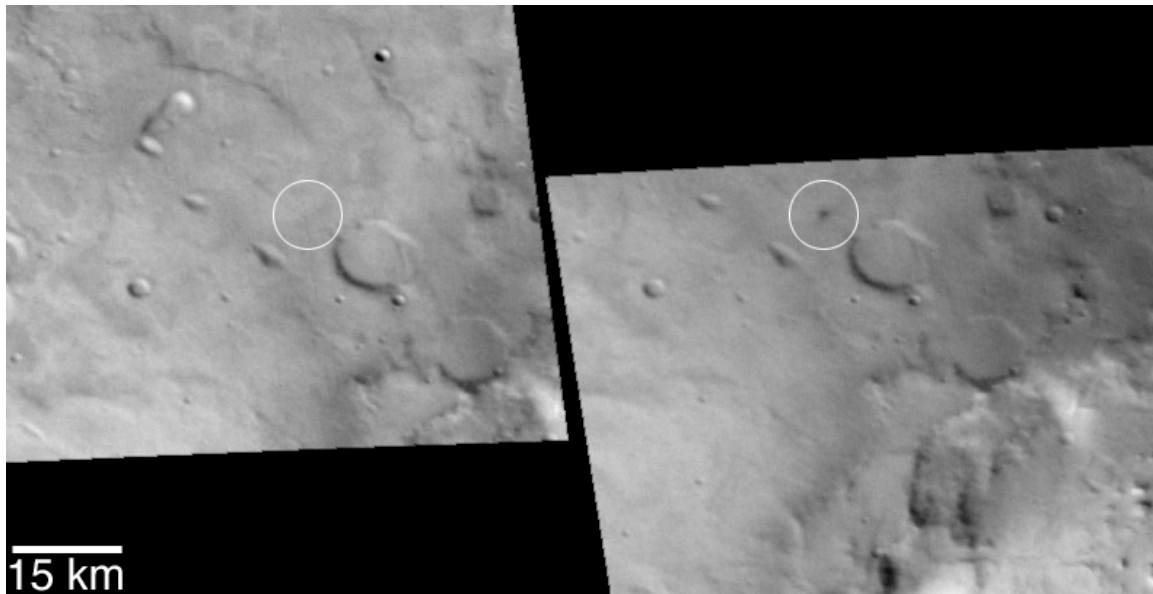
Sub-frame of MOC ROTO image S16-01105. Simple cylindrical projection; north is up.

Notes:

The impact site is a single crater with a 11.2 ± 3.0 m diameter.

Impact occurred in roughened mid-latitude mantle material.

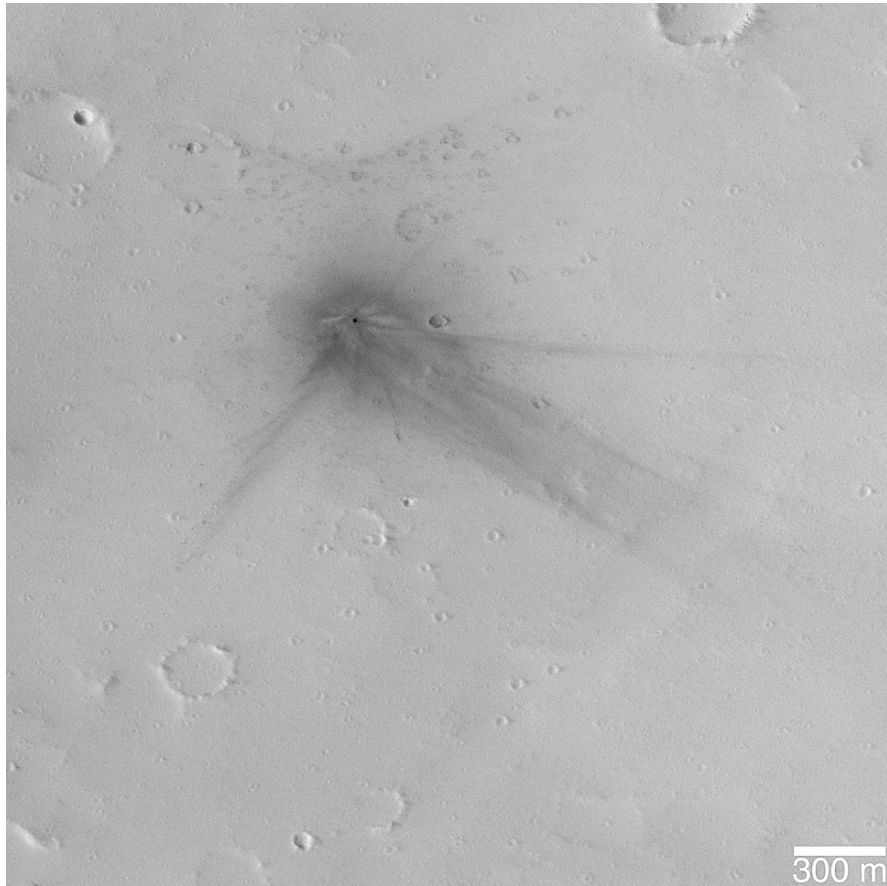
Impact Site 10, 29.3°N, 333.2°W (page 3 of 3)



Orbiter images showing the site before and after the impact; the white circle denotes the impact location. On the left is a sub-frame of MOC red wide angle image R05-00427 (5 May 2003). On the right is a sub-frame of MOC red wide angle image S05-01885 (29 April 2005). Each image is a simple cylindrical projection; north is up.

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Impact Site 11, 27.3°N, 91.8°W (page 1 of 4)



Sub-frame of MOC image S16-01140. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S16-01140 (ROTO, 13 March 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- R15-01052 (red wide angle, sample 218, line 346, 12 March 2004)

Most recent image before impact occurred:

- MOC R04-01354 (18 April 2003)

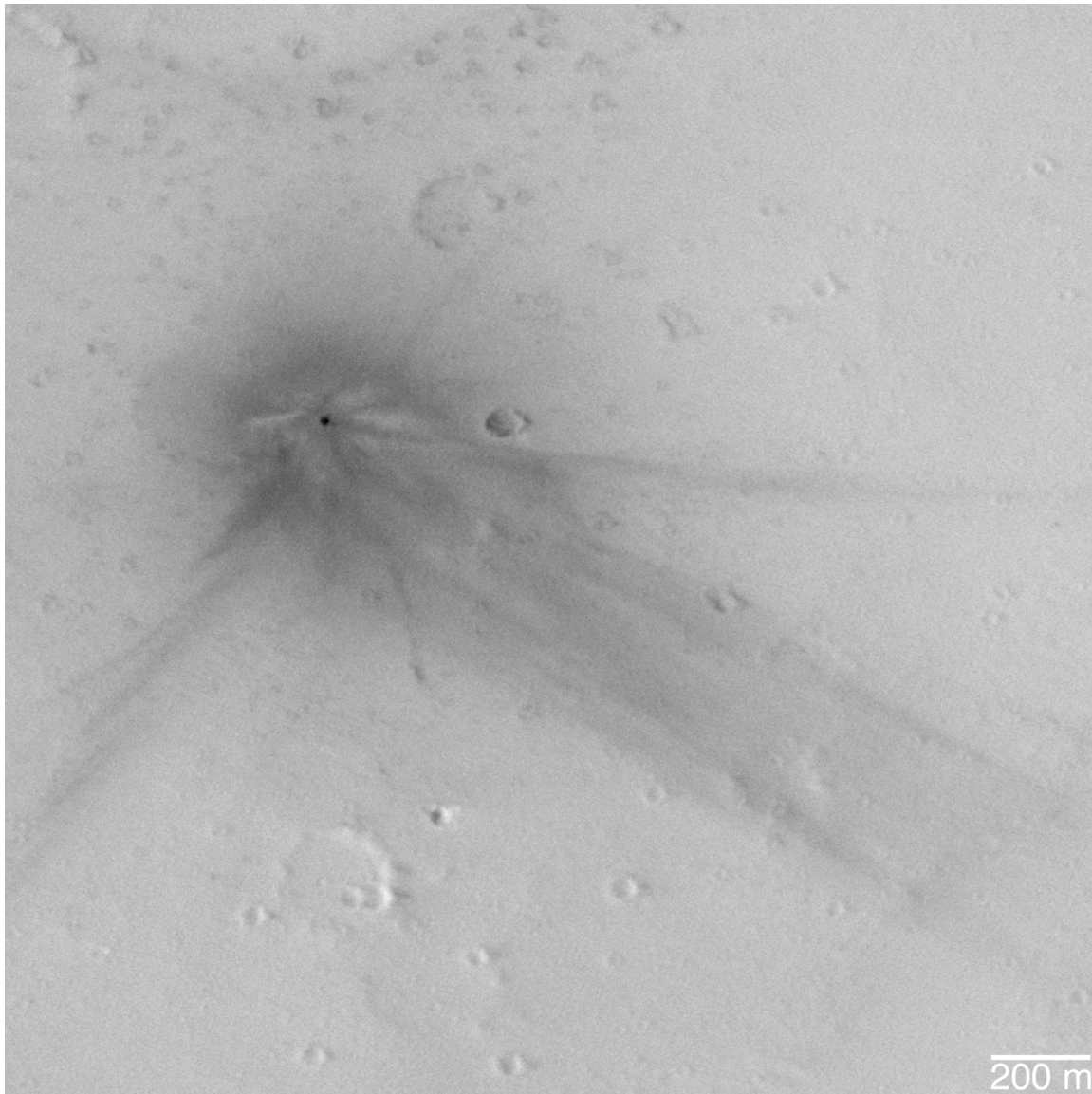
First image of impact site, after impact occurred:

- THEMIS I09540014 (7 February 2004)

Dates that constrain when impact occurred:

- 18 April 2003 – 7 February 2004

Impact Site 11, 27.3°N, 91.8°W (page 2 of 4)



Sub-frame of MOC ROTO image S16-01140. Simple cylindrical projection; north is up.

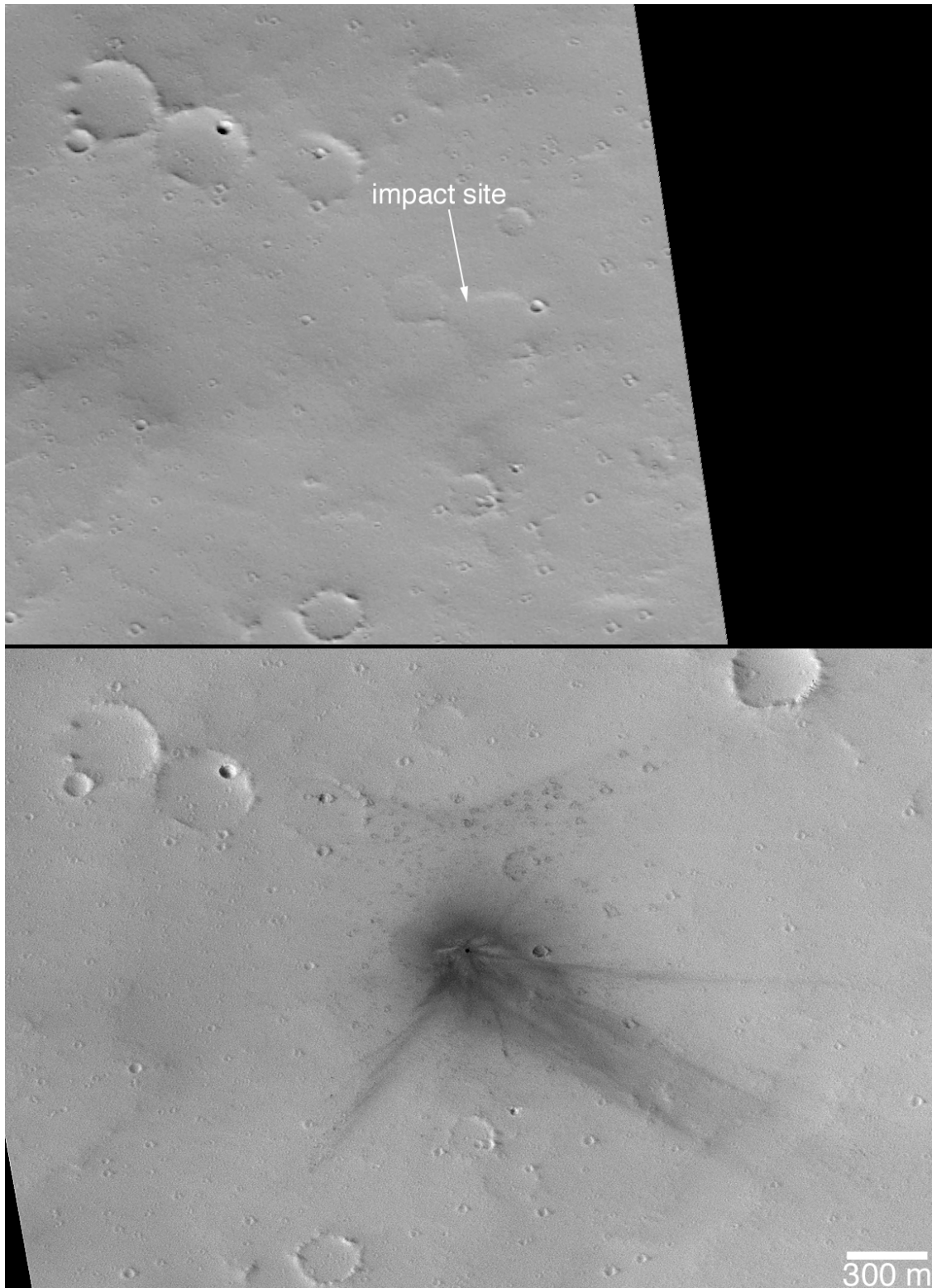
Notes:

The impact site is a single crater with a 19.8 ± 3.0 m diameter.

The impact site, which is on the upper north flank of Ulysses Patera, occurs in other orbiter images after 7 February 2004, including HRSC image H1052_0000_ND3 (13 November 2004).

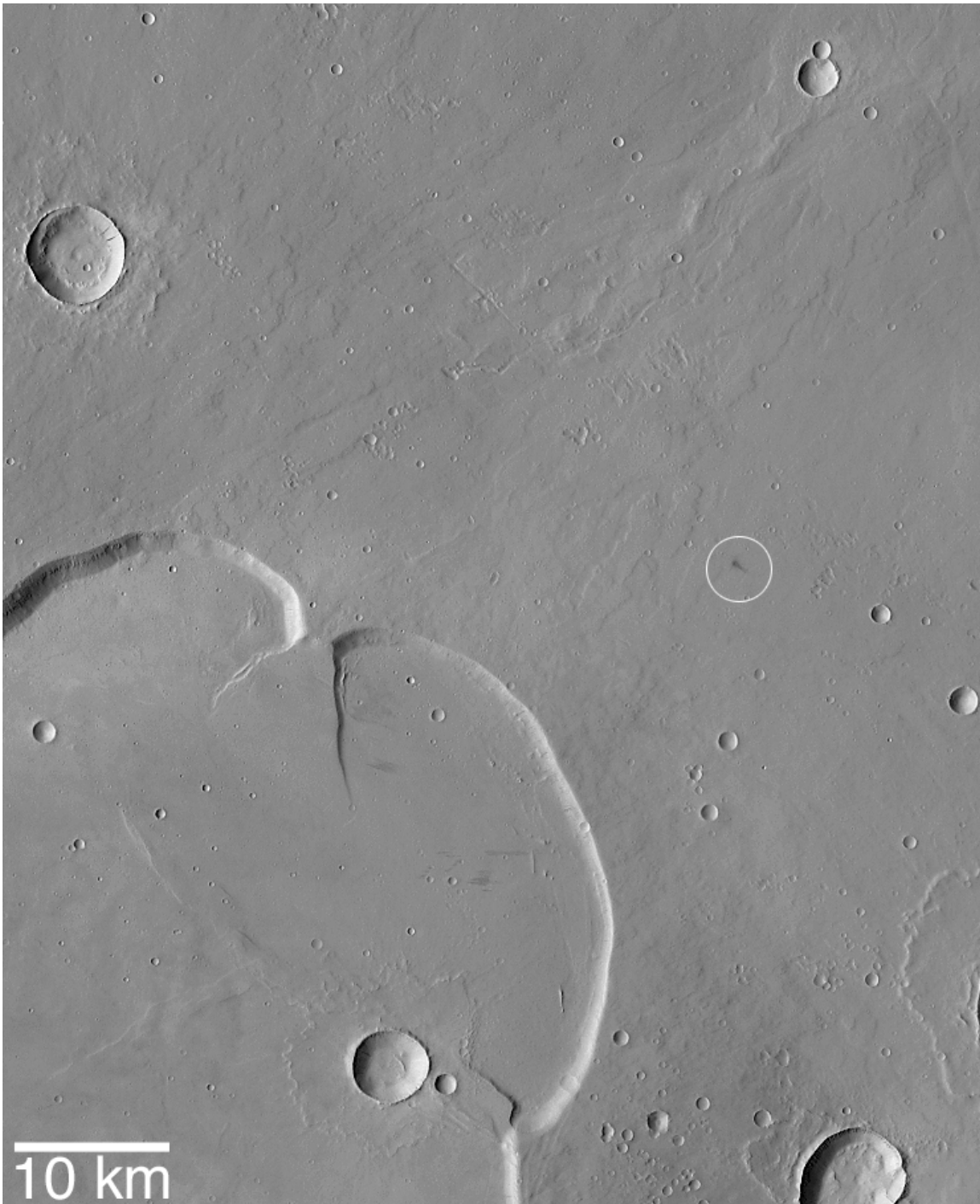
This is one of those very few cases where there was a MOC narrow angle camera image (E13-02112, 24 February 2002) acquired before the impact occurred (see figure on next page).

Impact Site 11, 27.3°N, 91.8°W (page 3 of 4)



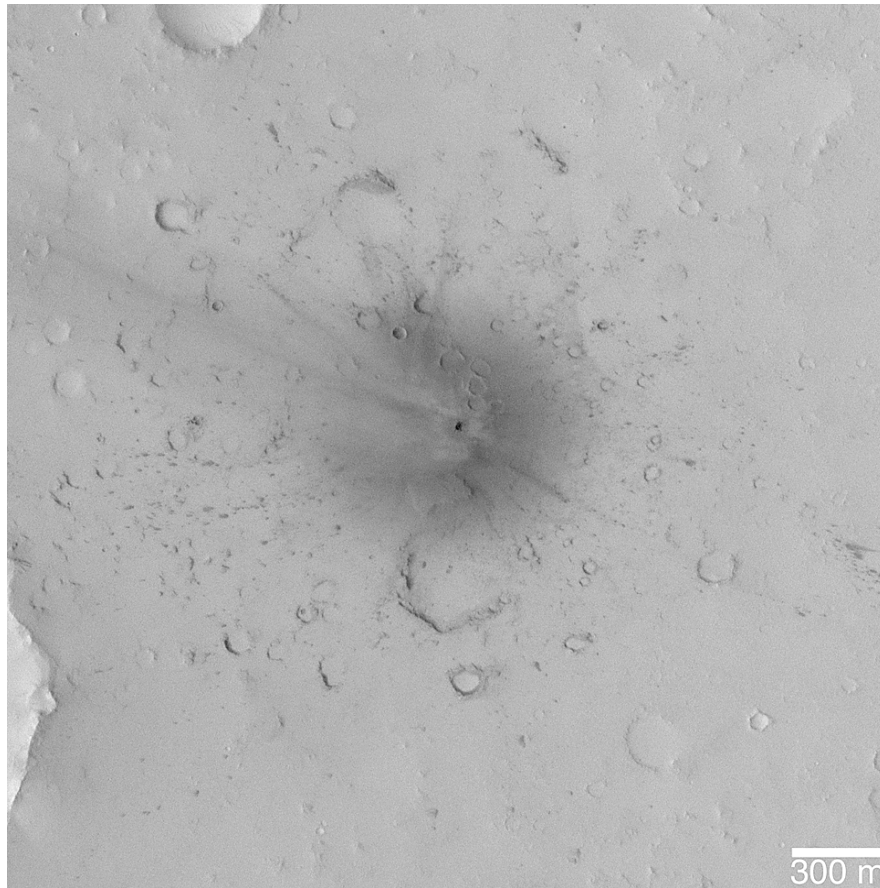
MOC narrow angle camera images showing the site before (top) and after (bottom) the impact. The first image is a sub-frame of MOC E13-02112 (24 February 2002). The lower image is a sub-frame of MOC S16-01140 (13 March 2006). Each image is a simple cylindrical projection; north is up.

Impact Site 11, 27.3°N, 91.8°W (page 4 of 4)



The impact site in context. The circle indicates the location of the small, fresh impact crater within a Mars Express HRSC image (H1052_0000_ND3; 13 November 2004). Sinusoidal equal area map projection archival product from the HRSC team; north is up.

Impact Site 12, 22.2°N, 345.5°W (page 1 of 3)



Sub-frame of MOC image S16-01199. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S16-01199 (ROTO, 13 March 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S15-00351 (red wide angle, sample 73, line 6791, 3 February 2006)

Most recent image before impact occurred:

- MOC E03-00127 (2 April 2001)

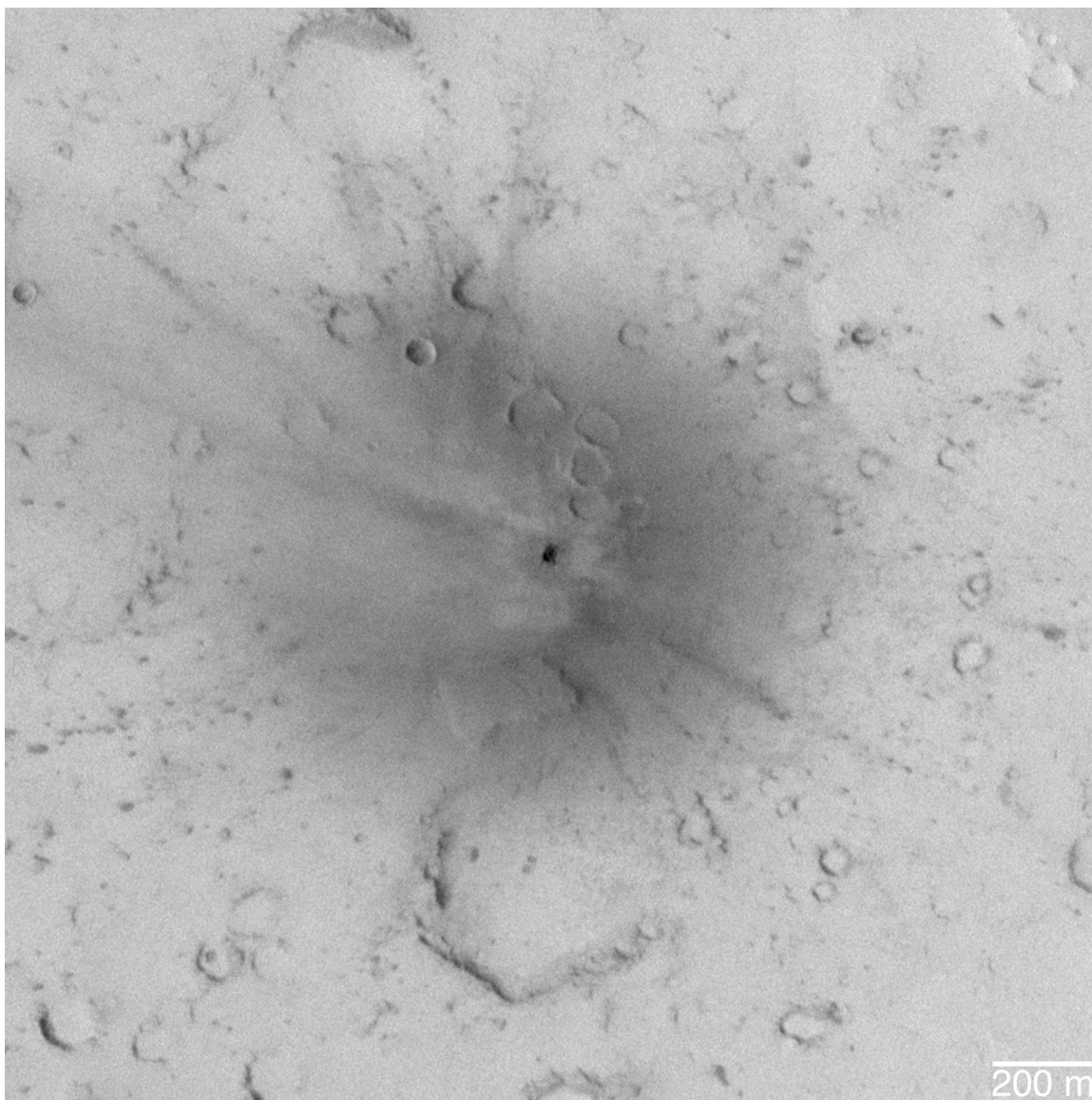
First image of impact site, after impact occurred:

- MOC R12-01350 (11 December 2003)

Dates that constrain when impact occurred:

- 2 April 2001 – 11 December 2003

Impact Site 12, 22.2°N, 345.5°W (page 2 of 3)

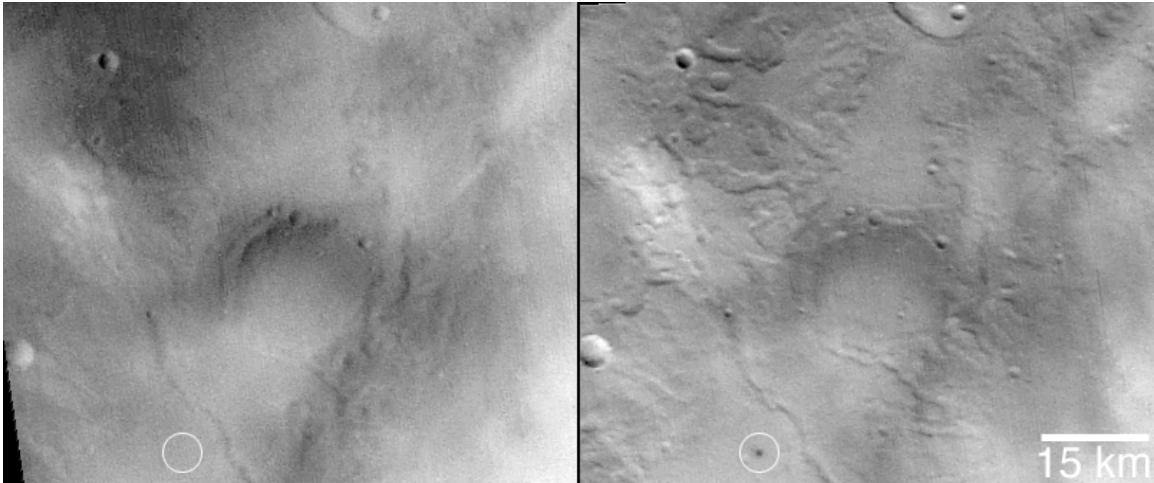


Sub-frame of MOC ROTO image S16-01199. Simple cylindrical projection; north is up.

Notes:

The impact site is a single crater with a 24.0 ± 3.0 m diameter.

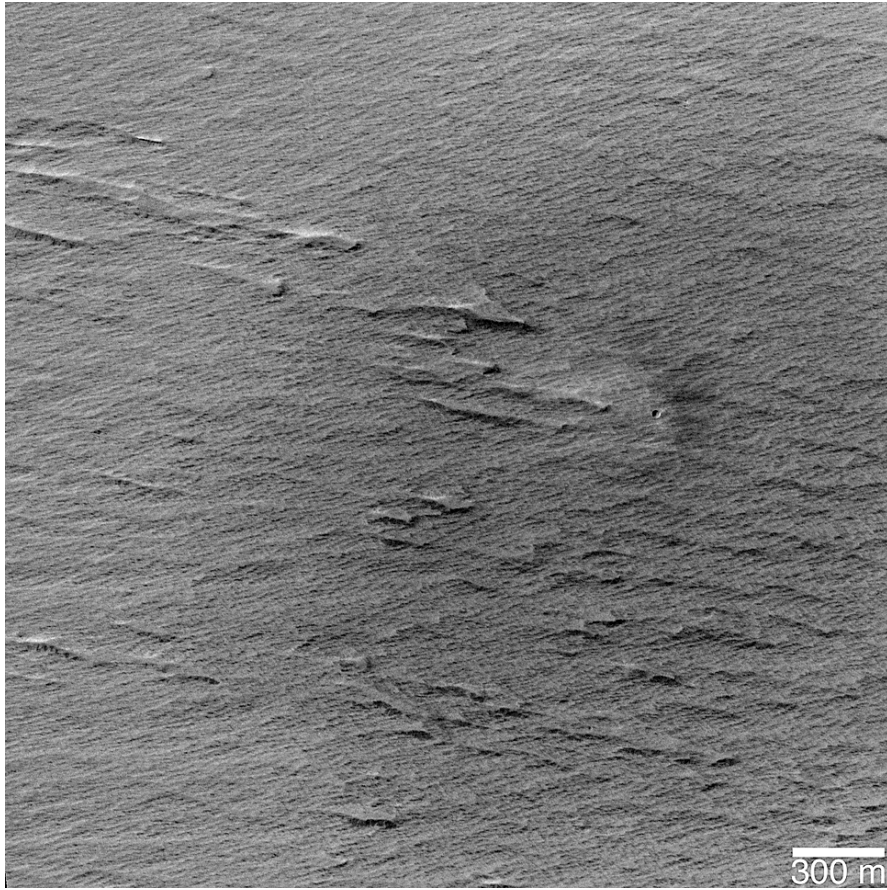
Impact Site 12, 22.2°N, 345.5°W (page 3 of 3)



Orbiter images showing the site before and after the impact; the white circle denotes the impact location. On the left is a sub-frame of MOC red wide angle image E03-00127 (2 April 2001). On the right is a sub-frame of MOC red wide angle image R12-01350 (11 December 2003). Each image is a simple cylindrical projection; north is up.

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Impact Site 13, 5.5°N, 135.7°W (page 1 of 3)



Sub-frame of MOC image S18-00653. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S16-01331 (ROTO, 15 March 2006)
- S18-00653 (ROTO, 8 May 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S15-01463 (red wide angle, sample 476, line 2958, 14 February 2006)

Most recent image before impact occurred:

- MOC M01-05675 (2 June 1999)

First image of impact site, after impact occurred:

- THEMIS I07457015 (20 August 2003)

Dates that constrain when impact occurred:

- 2 June 1999 – 20 August 2003

Impact Site 13, 5.5°N, 135.7°W (page 2 of 3)

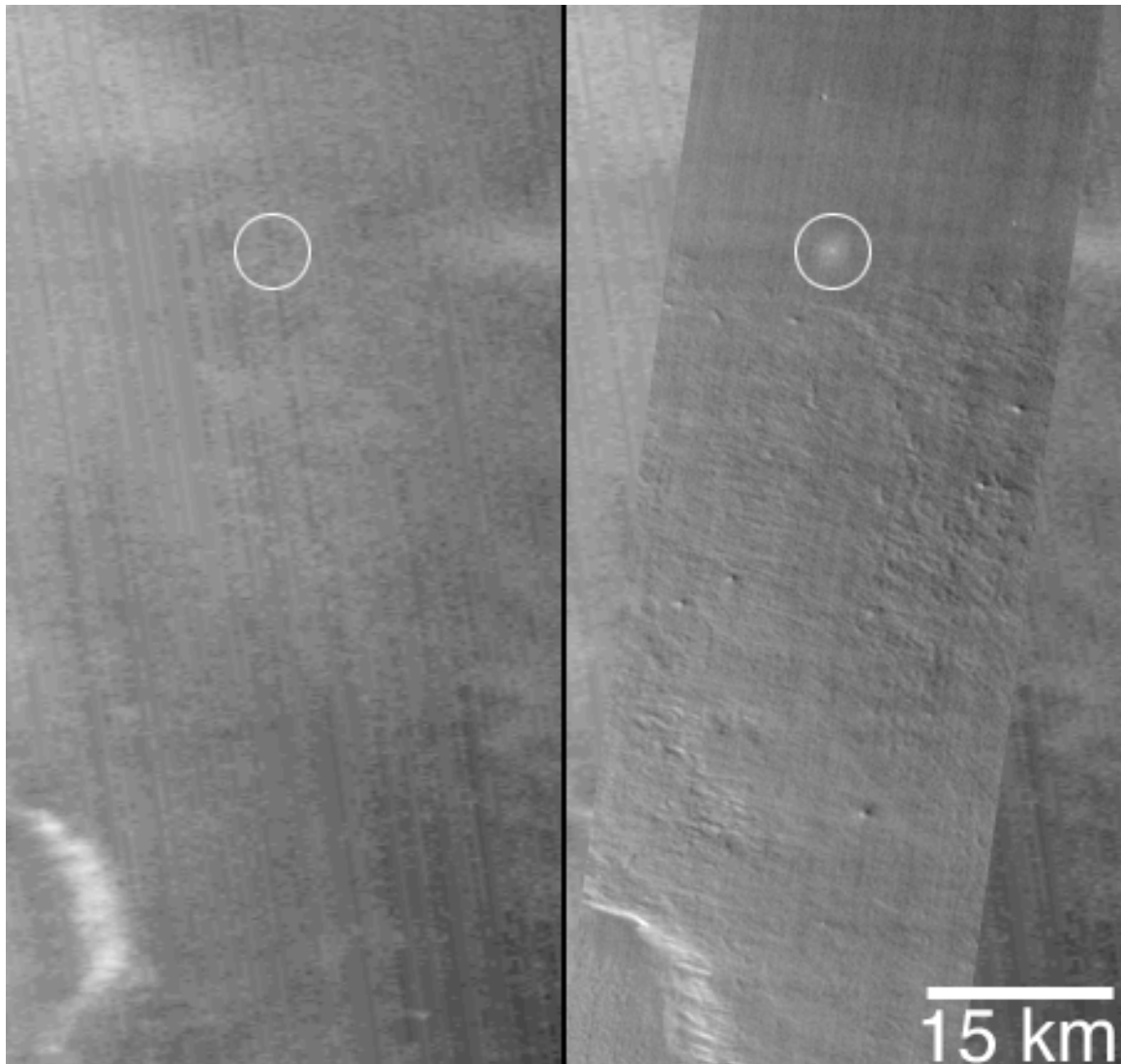


Sub-frame of MOC ROTO image S18-00653. Simple cylindrical projection; north is up.

Notes:

The impact site is a single crater with a 28.2 ± 3.0 m diameter. The impact feature can also be identified in THEMIS V13797015 (23 January 2005).

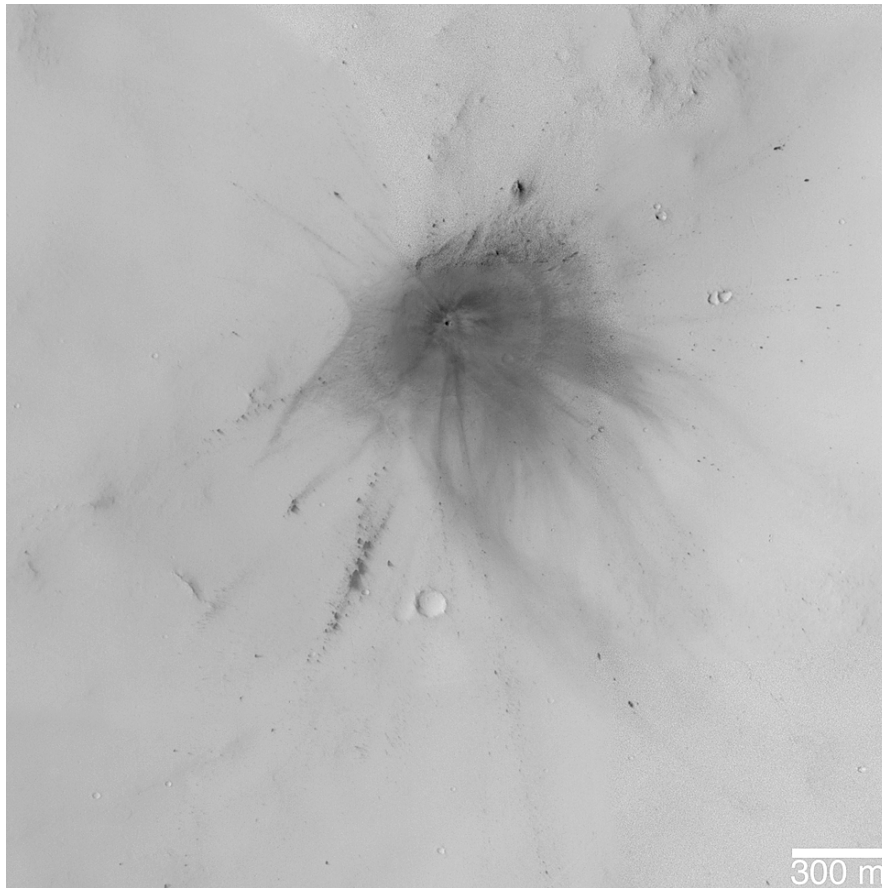
Impact Site 13, 5.5°N, 135.7°W (page 3 of 3)



Orbiter images showing the site before and after the impact; the white circle indicates the impact location. On the left is a sub-frame of MOC red wide angle image M01-05675 (2 June 1999). On the right is a sub-frame of THEMIS daytime infrared image I07457015 (band 9; 20 August 2003) superimposed on MOC image M01-05675. Each image is a simple cylindrical projection; north is up.

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Impact Site 14, 26.4°N, 336.5°W (page 1 of 3)



Composite of sub-frames of MOC ROTO and cPROTO images S16-01674, S17-00795, S17-02191, and S18-01407. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S16-01674 (ROTO, 20 March 2006)
- S17-00795 (cPROTO, 10 April 2006)
- S17-02191 (cPROTO, 27 April 2006)
- S18-01407 (cPROTO, 18 May 2006)
- S20-01581 (cPROTO, 26 July 2006, missed crater but has some secondaries)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S14-03323 (red wide angle, sample 364, line 7284, 31 January 2006)

Most recent image before impact occurred:

- MOC R12-00786 (8 December 2003)

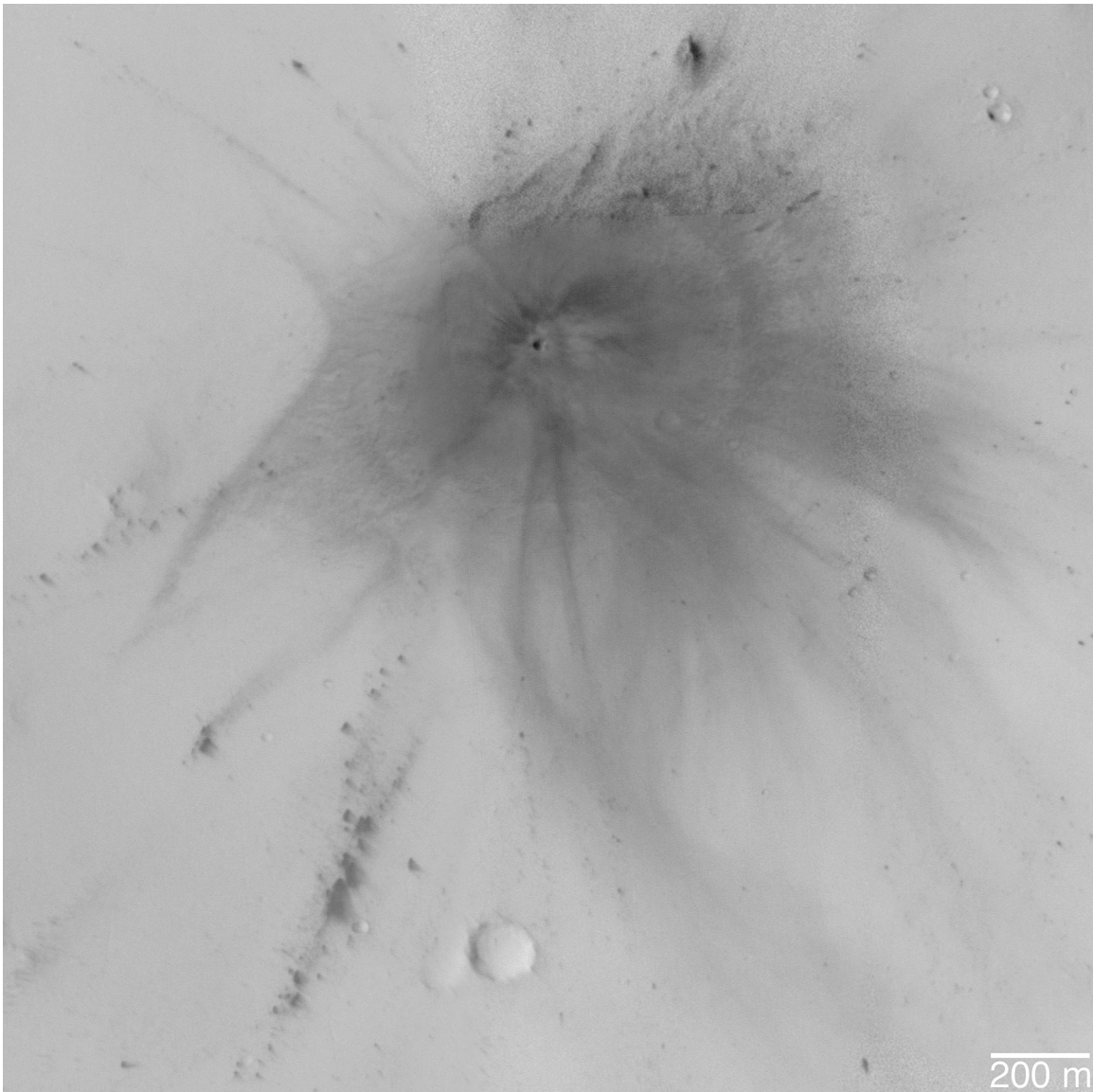
First image of impact site, after impact occurred:

- THEMIS I17523014 (26 November 2005)

Dates that constrain when impact occurred:

- 8 December 2003 – 26 November 2005

Impact Site 14, 26.4°N, 336.5°W (page 2 of 3)

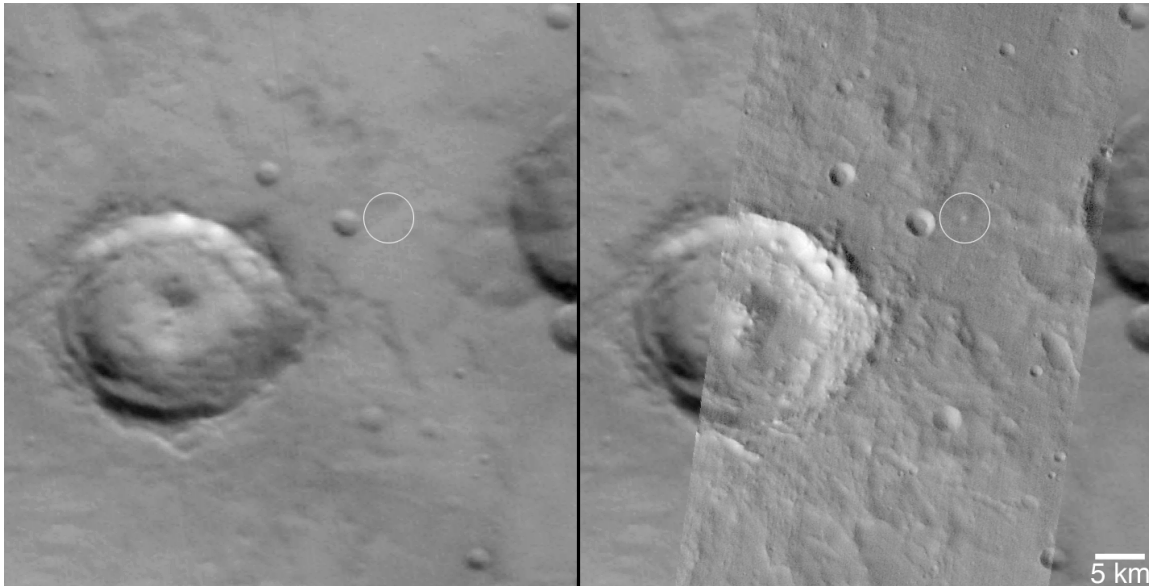


Composite of sub-frames of MOC ROTO and cPROTO images S16-01674, S17-00795, S17-02191, and S18-01407. Simple cylindrical projection; north is up.

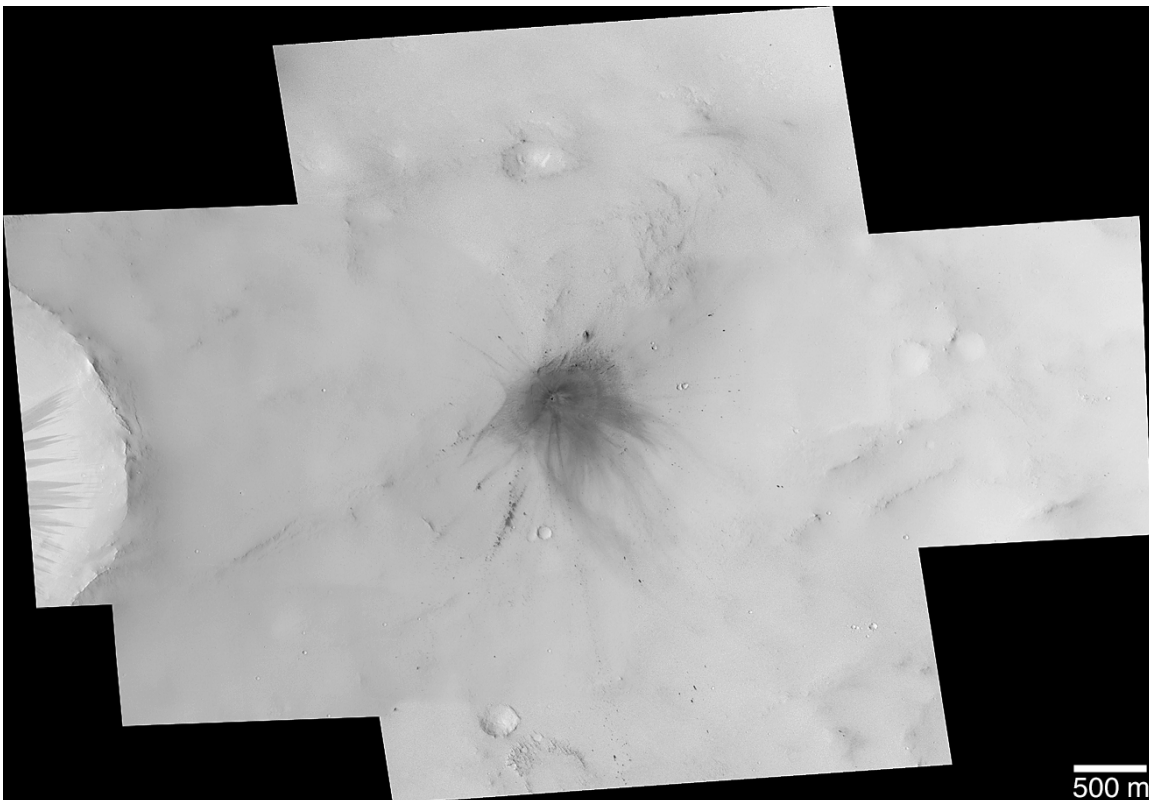
Notes:

The impact site is a single crater with a 22.6 ± 1.7 m diameter. Many small secondary impacts occurred and spread out several kilometers from the crater.

Impact Site 14, 26.4°N, 336.5°W (page 3 of 3)



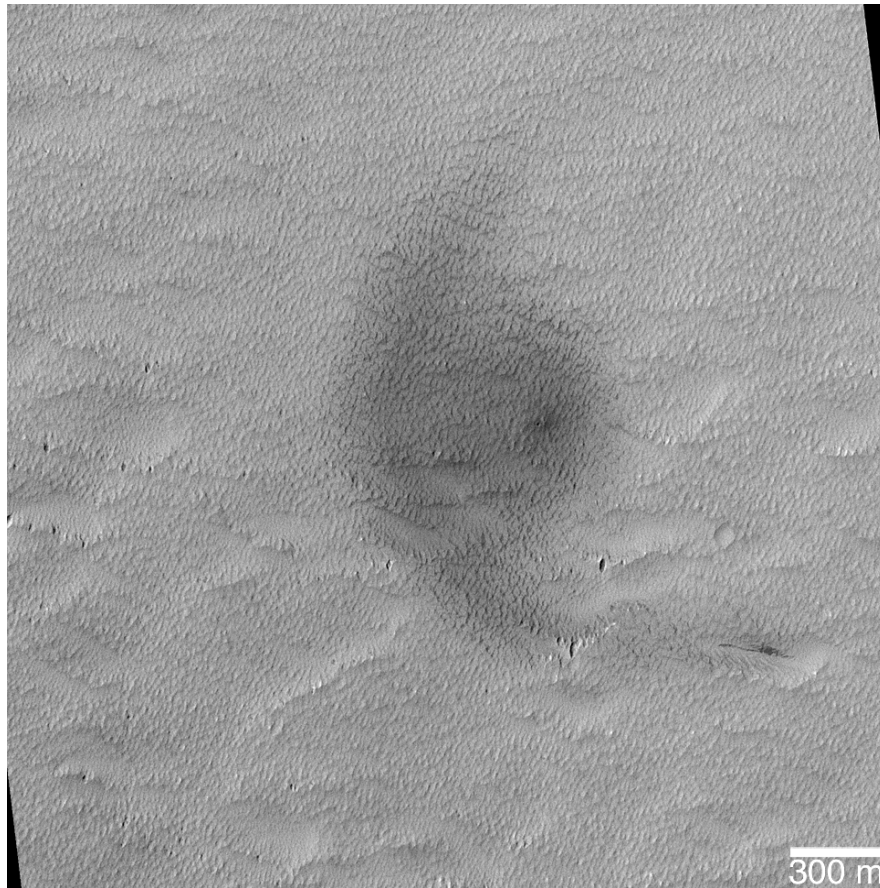
Orbiter images showing the site before and after the impact; the white circle indicates the impact location. On the left is a sub-frame of MOC red wide angle image R12-00786 (8 December 2003). On the right is a sub-frame of THEMIS daytime infrared image I17523014 (band 9; 26 November 2005) superimposed on MOC image R12-00786. Each image is a simple cylindrical projection; north is up.



Full mosaic of MOC narrow angle camera images of impact site. This is a composite of images S16-01674, S17-00795, S17-02191, and S18-01407; simple cylindrical projection; north is up.

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Impact Site 15, 1.7°N, 160.7°W (page 1 of 3)



Sub-frame of MOC image S17-00774. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S17-00774 (ROTO, 10 April 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S16-00224 (red wide angle, sample 765, line 505, 3 March 2006)

Most recent image before impact occurred:

- THEMIS I07720022 (11 September 2003)

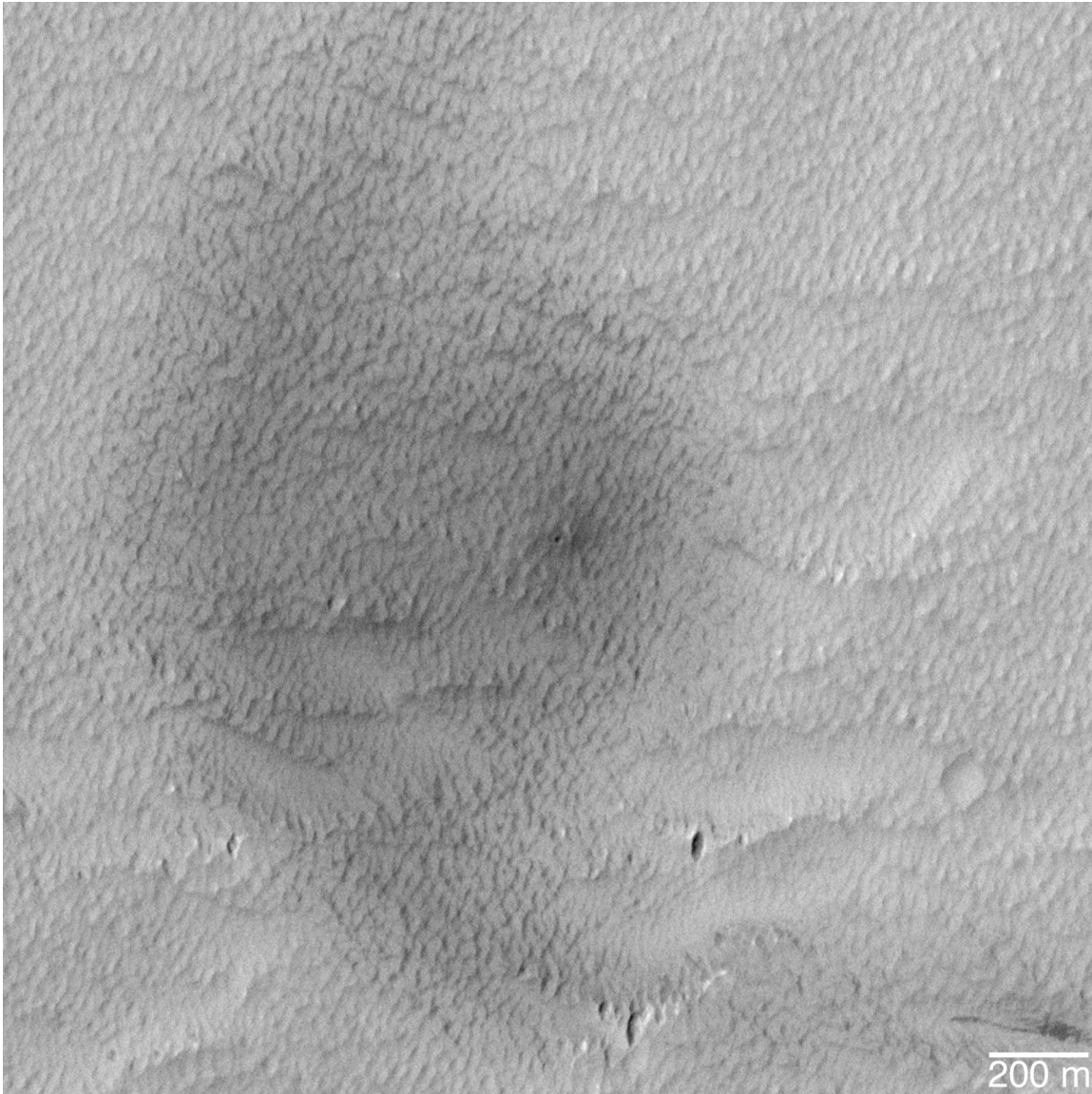
First image of impact site, after impact occurred:

- THEMIS I09405011 (27 January 2004)

Dates that constrain when impact occurred:

- 11 September 2003 – 27 January 2004

Impact Site 15, 1.7°N, 160.7°W (page 2 of 3)



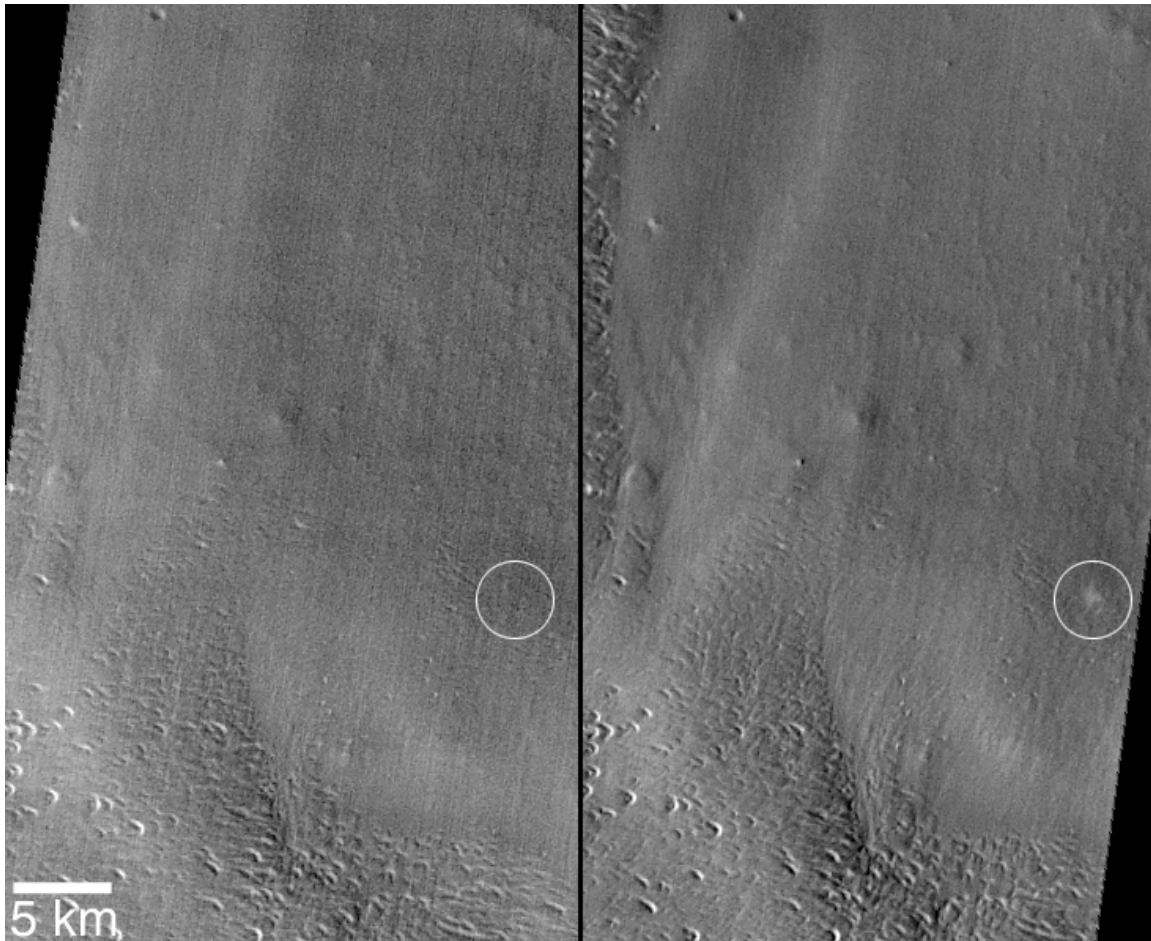
Sub-frame of MOC ROTO image S17-00774. Simple cylindrical projection; north is up.

Notes:

The impact site is a single crater with a 14.0 ± 3.0 m diameter. Note dark parabola of disrupted surface material.

This impact site can also be seen in THEMIS VIS images V13698008 (15 January 2005) and V17080020 (20 October 2005).

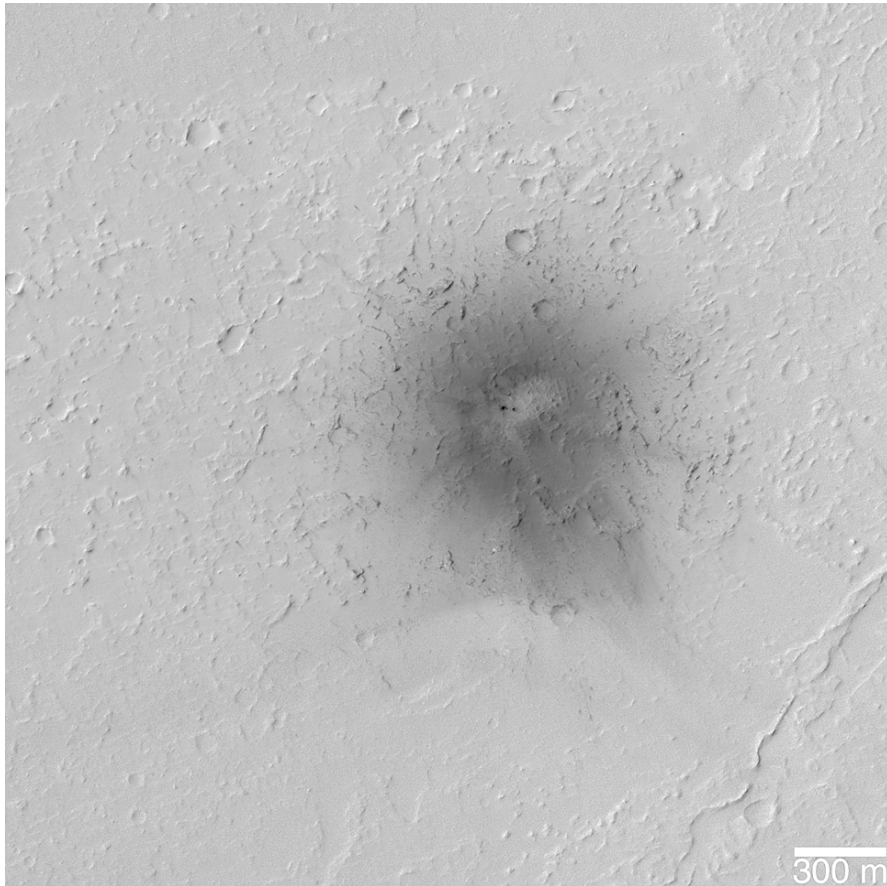
Impact Site 15, 1.7°N, 160.7°W (page 3 of 3)



Orbiter images showing the site before (left) and after (right) the impact; the white circle indicates the impact location. On the left is a sub-frame of THEMIS image I07720022 (band 9; 11 September 2003); on the right is a sub-frame of THEMIS image I09405011 (band 9; 27 January 2004). Each image is a simple cylindrical projection; north is up.

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Impact Site 16, 13.9°N, 84.4°W (page 1 of 3)



Composite of sub-frames of MOC ROTO and cPROTO images S17-00998 and S18-01821. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S17-00998 (ROTO, 13 April 2006)
- S18-01821 (cPROTO, 23 May 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S15-02768 (red wide angle, sample 383, line 3665, 26 February 2006)

Most recent image before impact occurred:

- certain: THEMIS I09652013 (17 February 2004)
- less certain: THEMIS V11499008 (18 July 2004)

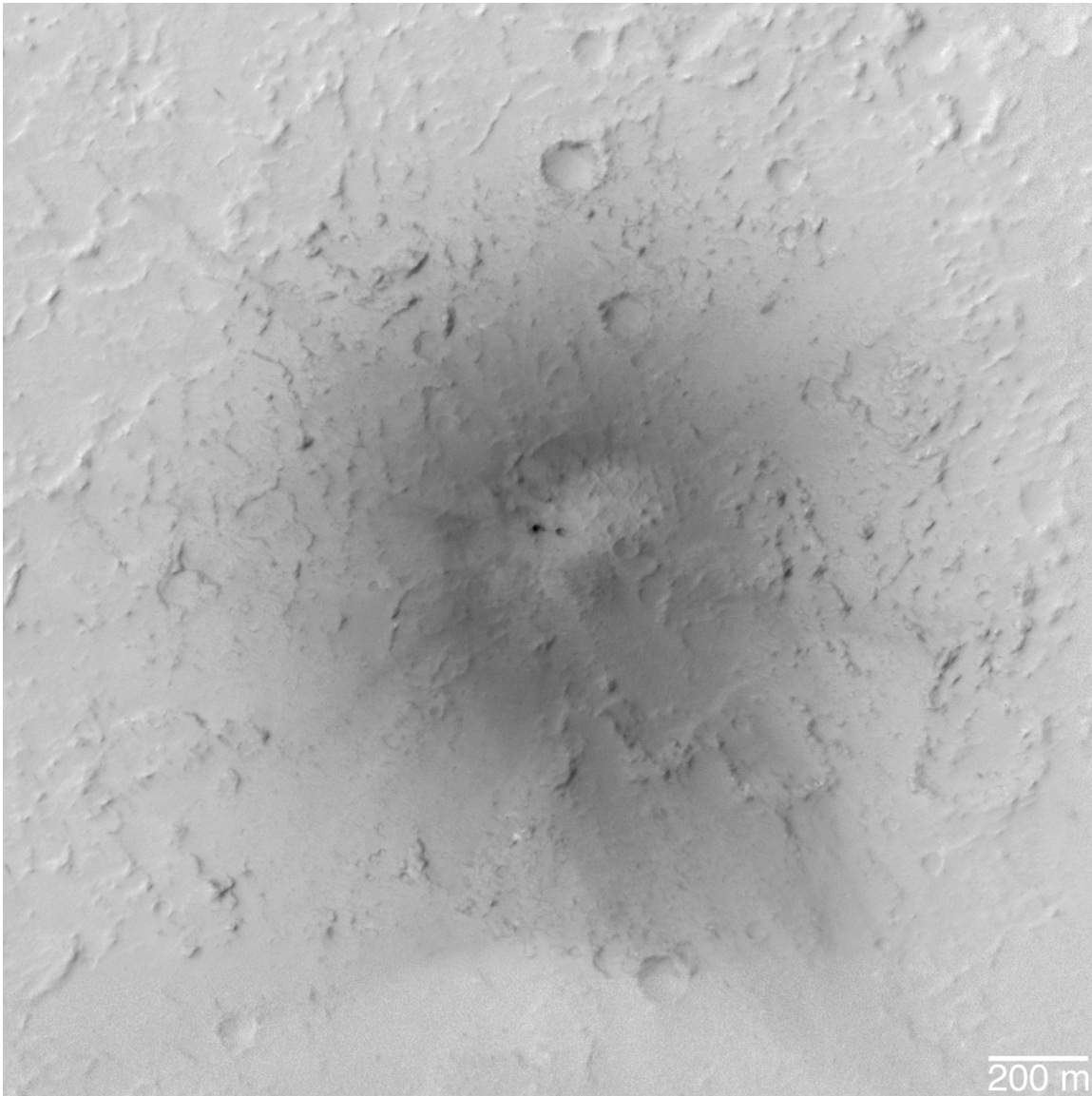
First image of impact site, after impact occurred:

- MOC S15-02768 (26 February 2006)

Dates that constrain when impact occurred:

- certain: 17 February 2004 – 26 February 2006
- less certain: 18 July 2004 – 26 February 2006

Impact Site 16, 13.9°N, 84.4°W (page 2 of 3)



Composite of sub-frames of MOC ROTO and cPROTO images S17-00998 and S18-01821. Simple cylindrical projection; north is up.

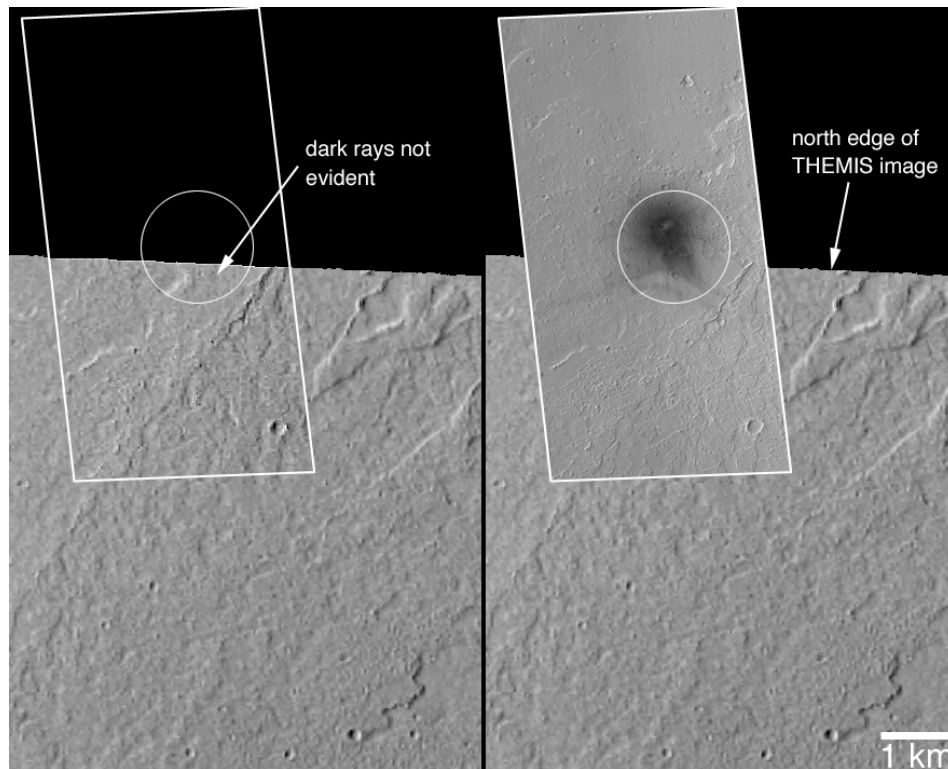
Notes:

The impact site includes two craters, the largest has a diameter of 12.6 ± 1.7 m, the smaller is about 4.2 ± 1.7 m across.

Impact Site 16, 13.9°N, 84.4°W (page 3 of 3)



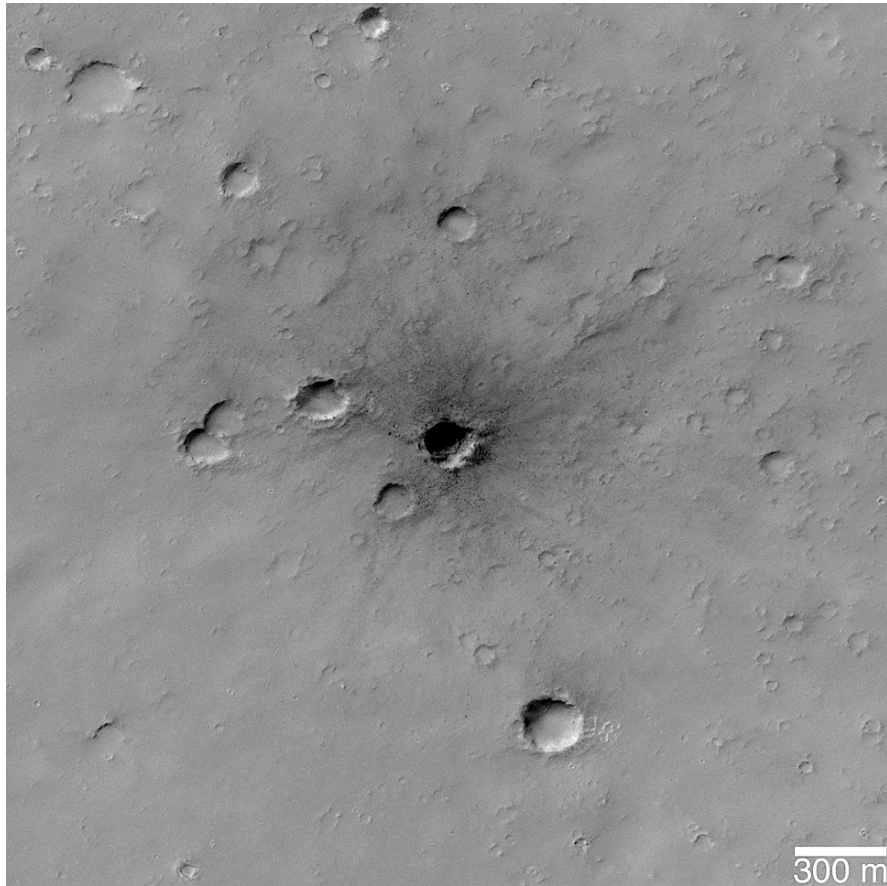
Orbiter images showing the site before (left) and after (right) the impact; the white circle indicates the impact location. On the left is a sub-frame of THEMIS image I09652013 (band 9; 17 February 2004); on the right is a sub-frame of MOC red wide angle image S15-02768 (26 February 2006). Each image is a simple cylindrical projection; north is up.



THEMIS VIS image V11499008 (band 3; 18 July 2004) might help constrain when the impact occurred, but the impact spot itself is not present in the image (left). The north end of the THEMIS image is located less than 1 km from the impact craters. However, as noted by the white circle, if the impact had occurred before the THEMIS image was acquired, then dark rays would have been evident. The smaller image (right) is MOC S17-00998. Each image is a simple cylindrical projection; north is up.

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Impact Site 17, 25.7°S, 136.2°W (page 1 of 3)



Sub-frame of MOC image S17-01187. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S17-01187 (ROTO, 15 April 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S15-02021 (red wide angle, sample 500, line 1915, 19 February 2006)

Most recent image before impact occurred:

- MOC E02-02262 (25 March 2001), *unless crater was obscured by haze*

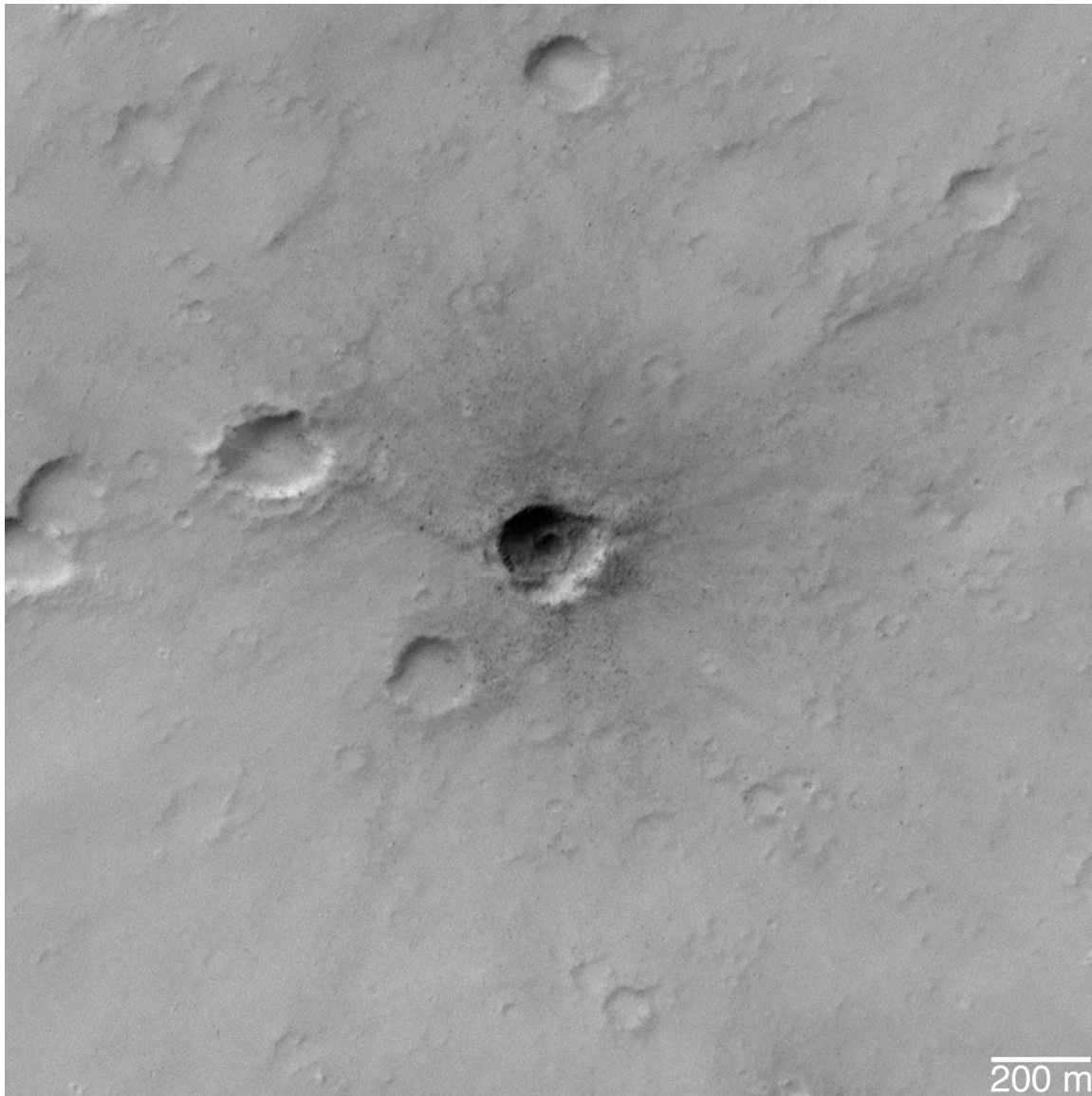
First image of impact site, after impact occurred:

- THEMIS I04755006 (9 January 2003)

Dates that constrain when impact occurred:

- 25 March 2001 – 9 January 2003

Impact Site 17, 25.7°S, 136.2°W (page 2 of 3)



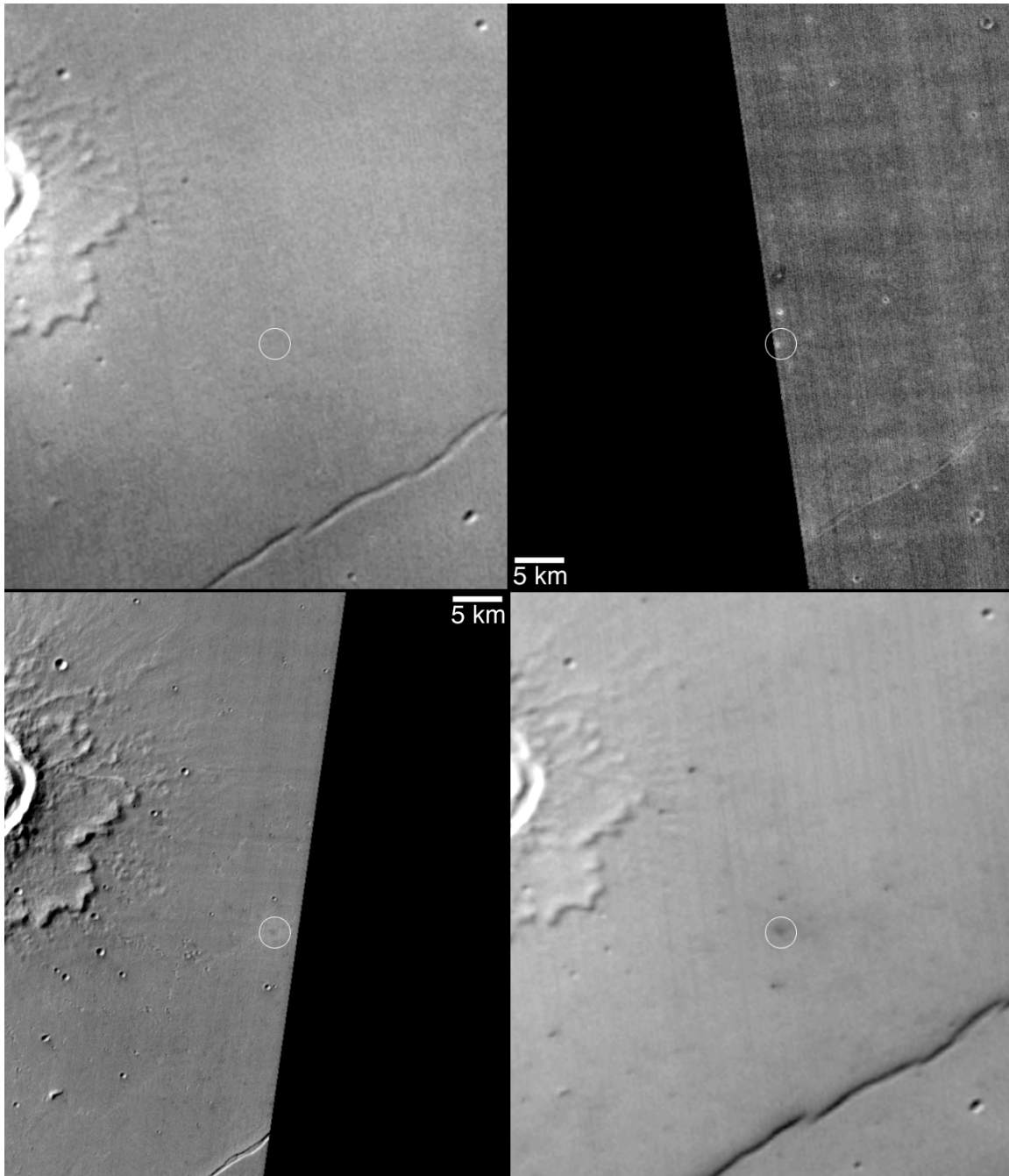
Sub-frame of MOC ROTO image S17-01187. Simple cylindrical projection; north is up.

Notes:

The impact site has a single crater of 148 ± 3 m diameter.

We are not certain that this crater is new. It might have existed before 1999, as it is so different from the other craters in this study in that it lacks a particularly large, dark, blast zone relative to the crater size. We were, however, unable to see the crater in any images acquired before THEMIS I04755006 (9 January 2003), including Viking orbiter data.

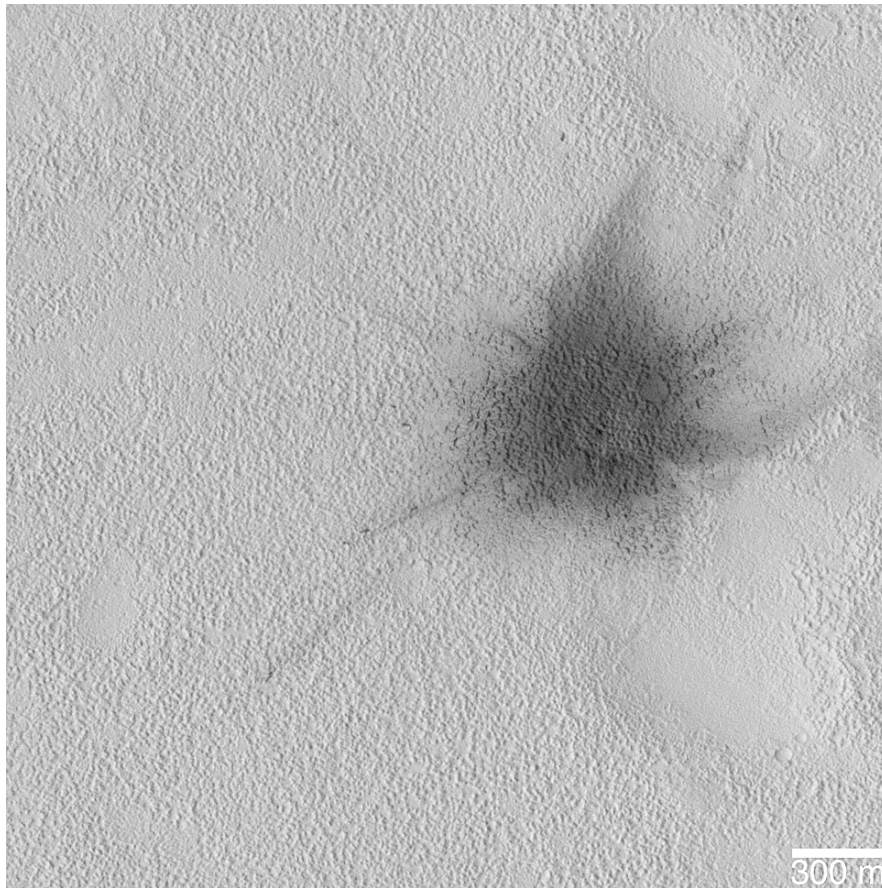
Impact Site 17, 25.7°S, 136.2°W (page 2 of 3)



Orbiter images showing the site before (top left) and after (the other three pictures) the impact; the white circle indicates the impact location. The top left picture, acquired before the impact, is a sub-frame of MOC red wide angle image E02-02262 (25 March 2001). At the top right is a sub-frame of THEMIS night-time infrared image I04755006 (band 9; 9 January 2003), the first image acquired after the impact occurred. At the lower left is a sub-frame of THEMIS day-time infrared image I10653003 (band 9; 9 May 2004), and at the lower right is a sub-frame of MOC red wide angle image S17-01188 (15 April 2006). Each image is a simple cylindrical projection; north is up.

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Impact Site 18, 28.7°N, 334.9°W (page 1 of 3)



Sub-frame of MOC image S17-01561. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S17-01561 (ROTO, 19 April 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S15-02721 (red wide angle, sample 209, line 3815, 26 February 2006)

Most recent image before impact occurred:

- HRSC H1483_0000_ND3 (14 March 2005)

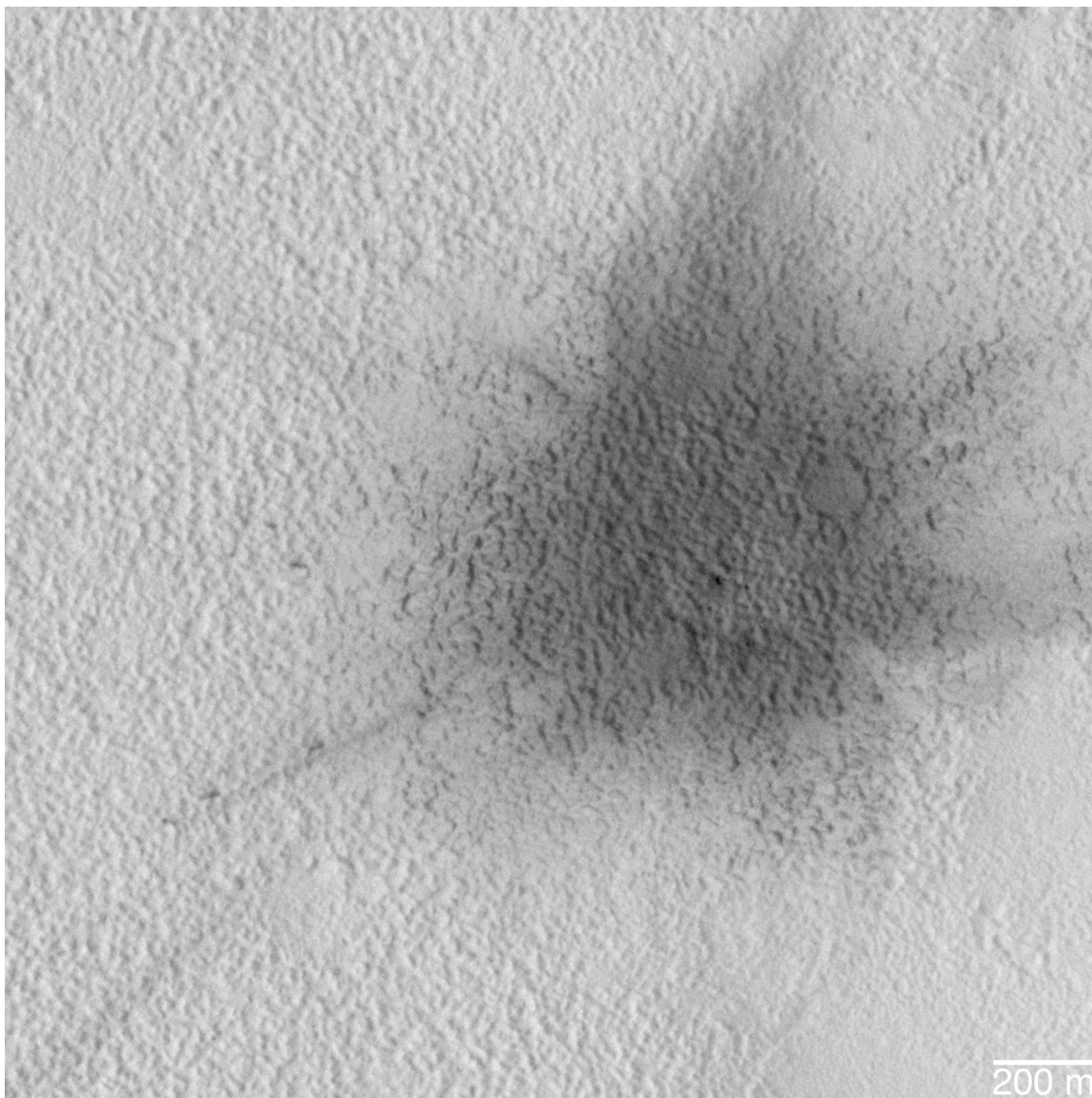
First image of impact site, after impact occurred:

- MOC S15-02721 (26 February 2006)

Dates that constrain when impact occurred:

- 14 March 2005 – 26 February 2006

Impact Site 18, 28.7°N, 334.9°W (page 2 of 3)

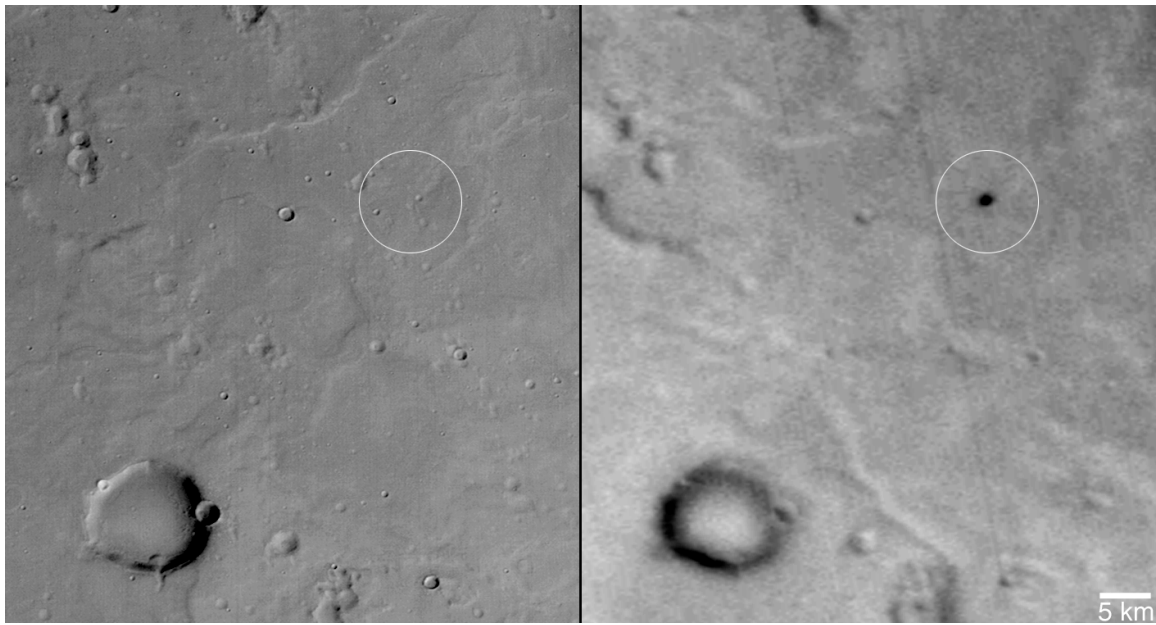


Sub-frame of MOC ROTO image S17-01561. Simple cylindrical projection; north is up.

Notes:

The impact site has two craters, one of 12.0 ± 3.0 m diameter, the other about 6.0 ± 3.0 m in diameter.

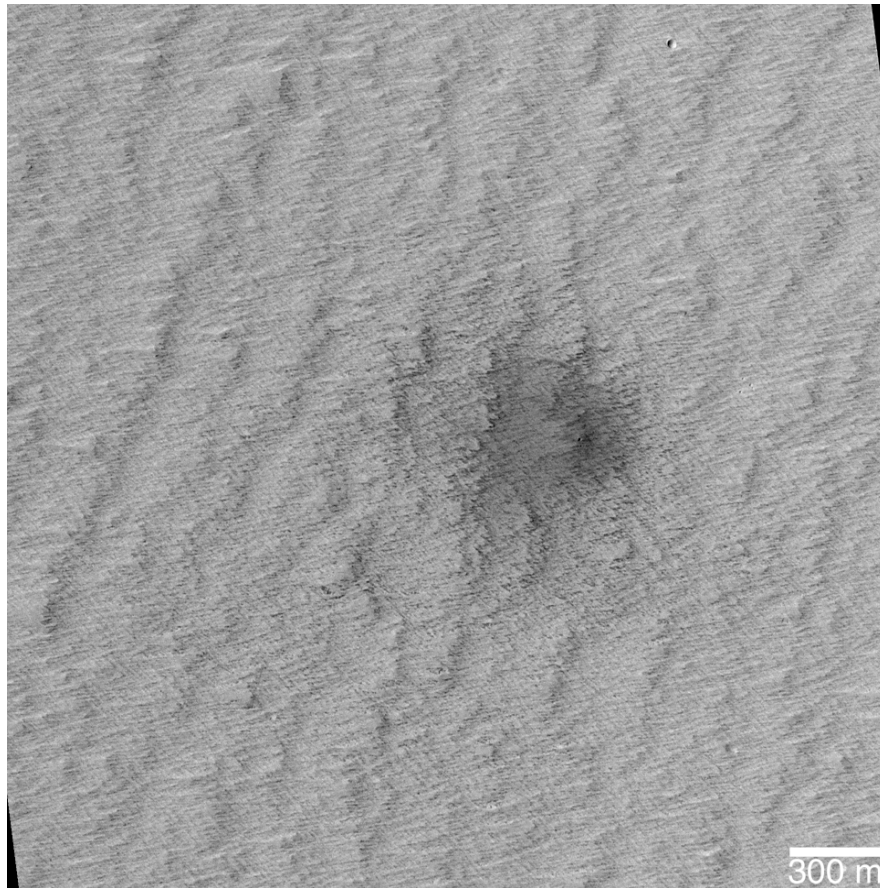
Impact Site 18, 28.7°N, 334.9°W (page 3 of 3)



Orbiter images showing the site before (left) and after (right) the impact; the white circle indicates the impact location. At the left is a sub-frame of HRSC image H1483_0000_ND3 (14 March 2005); to the right is a sub-frame of MOC red wide angle image S15-02721 (26 February 2006). Each image is a simple cylindrical projection; north is up.

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Impact Site 19, 5.4°N, 136.8°W (page 1 of 3)



Sub-frame of MOC image S17-01972. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S17-01972 (ROTO, 24 April 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S15-01463 (red wide angle, sample 247, line 2953, 14 February 2006)

Most recent image before impact occurred:

- MOC R13-03428 (22 January 2004)

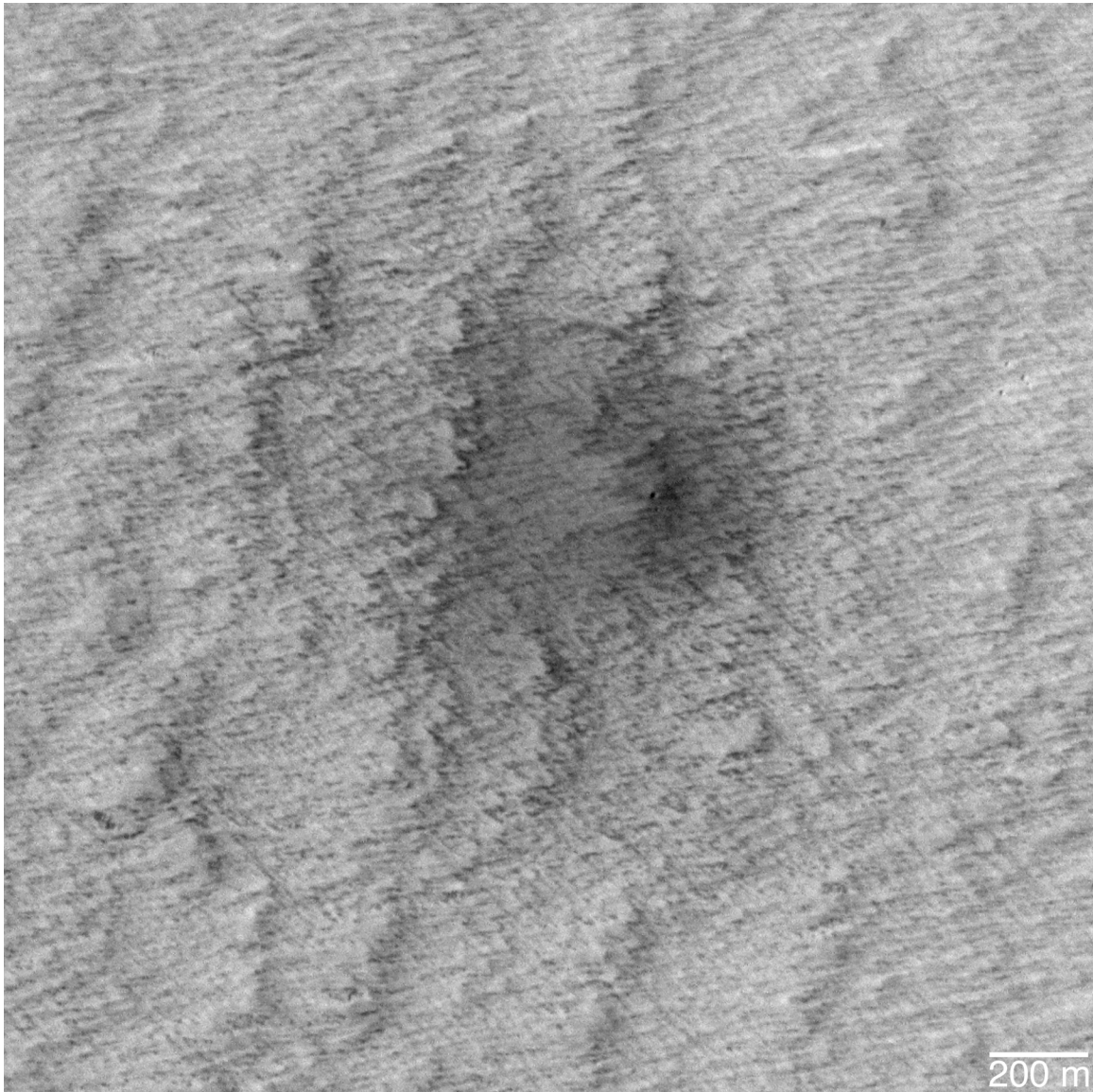
First image of impact site, after impact occurred:

- THEMIS I10440047 (22 April 2004)

Dates that constrain when impact occurred:

- 22 January 2004 – 22 April 2004 (88 day interval)

Impact Site 19, 5.4°N, 136.8°W (page 2 of 3)

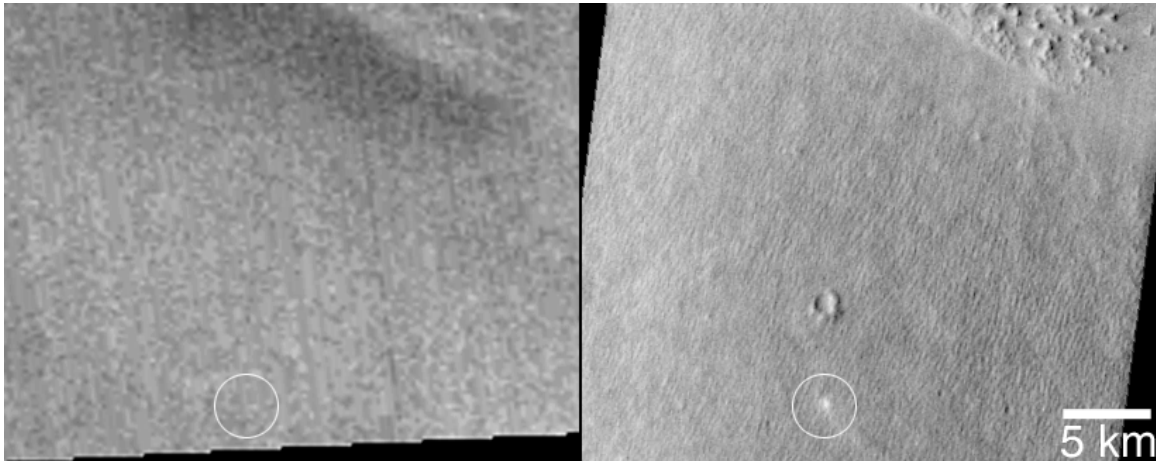


Sub-frame of MOC ROTO image S17-01972. Simple cylindrical projection; north is up.

Notes:

The impact site two craters, one of about 10.0 ± 3 m in diameter, the other about 4.0 ± 3 m in diameter. The site, post-impact, also appears in THEMIS VIS image V11975013 (26 August 2004).

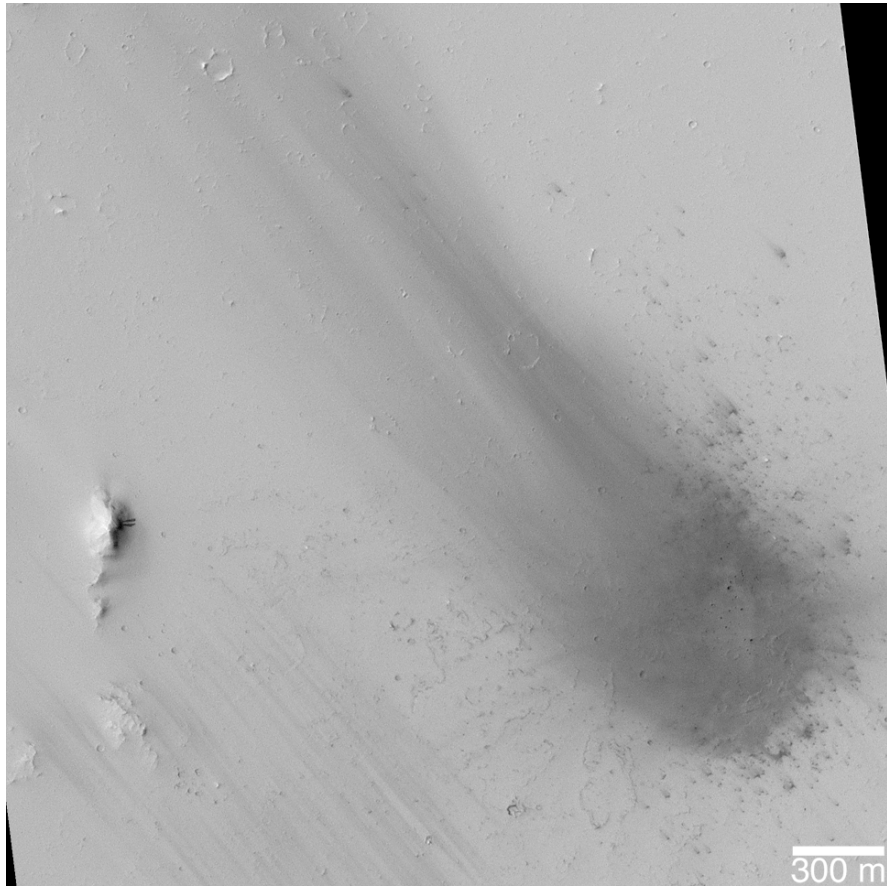
Impact Site 19, 5.4°N, 136.8°W (page 3 of 3)



Orbiter images showing the site before (left) and after (right) the impact; the white circle indicates the impact location. At the left is a sub-frame of MOC red wide angle R13-03428 (22 January 2004); to the right is a sub-frame of THEMIS daytime infrared image I10440047 (band 9; 22 April 2004). Each image is a simple cylindrical projection; north is up.

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Impact Site 20, 7.0°N, 112.2°W (page 1 of 3)



Sub-frame of MOC image S18-00492. Simple cylindrical projection; north is up.

MOC NA images of the impact site, after impact occurred:

- S18-00492 (ROTO, 6 May 2006)

MOC image in which dark spot (potential impact site) was identified for targeting:

- S15-02778 (red wide angle, sample 165, line 2861, 26 February 2006)

Most recent image before impact occurred:

- THEMIS I16679016 (17 September 2005)

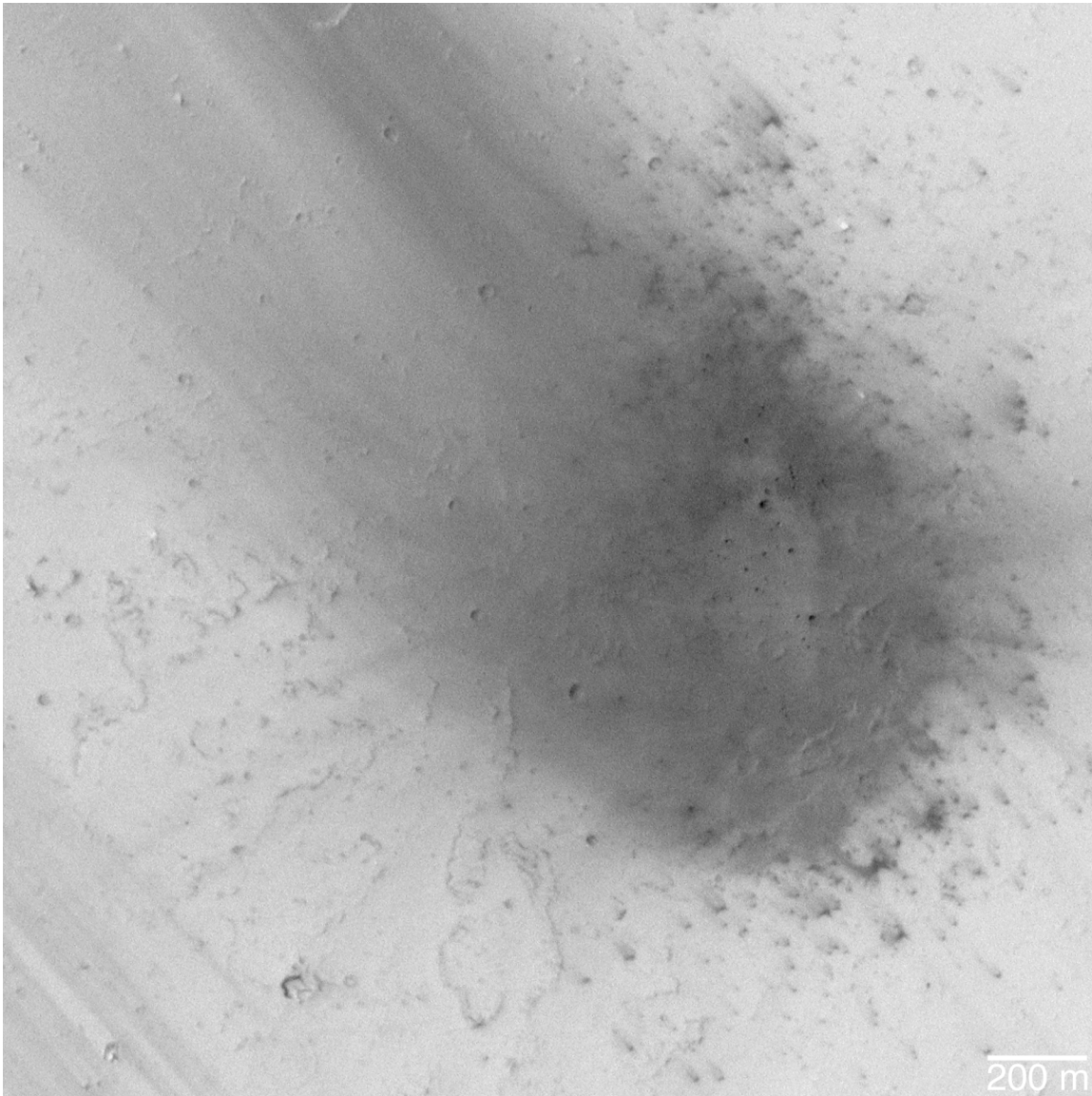
First image of impact site, after impact occurred:

- MOC S15-02778 (26 February 2006)

Dates that constrain when impact occurred:

- 17 September 2005 – 26 February 2006

Impact Site 20, 7.0°N, 112.2°W (page 2 of 3)

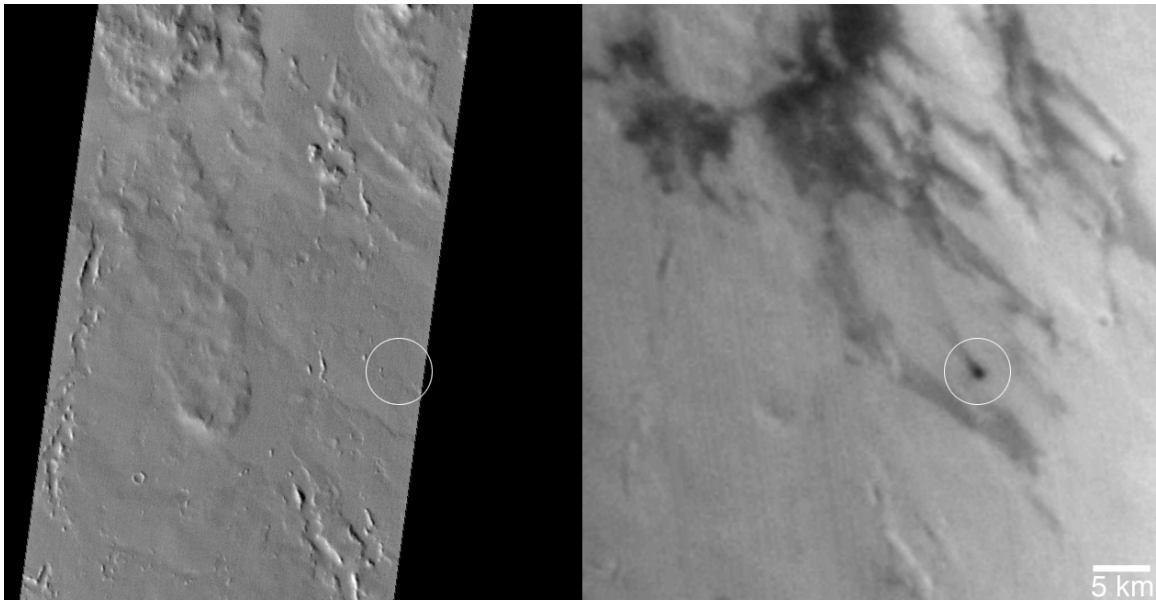


Sub-frame of MOC ROTO image S18-00492. Simple cylindrical projection; north is up.

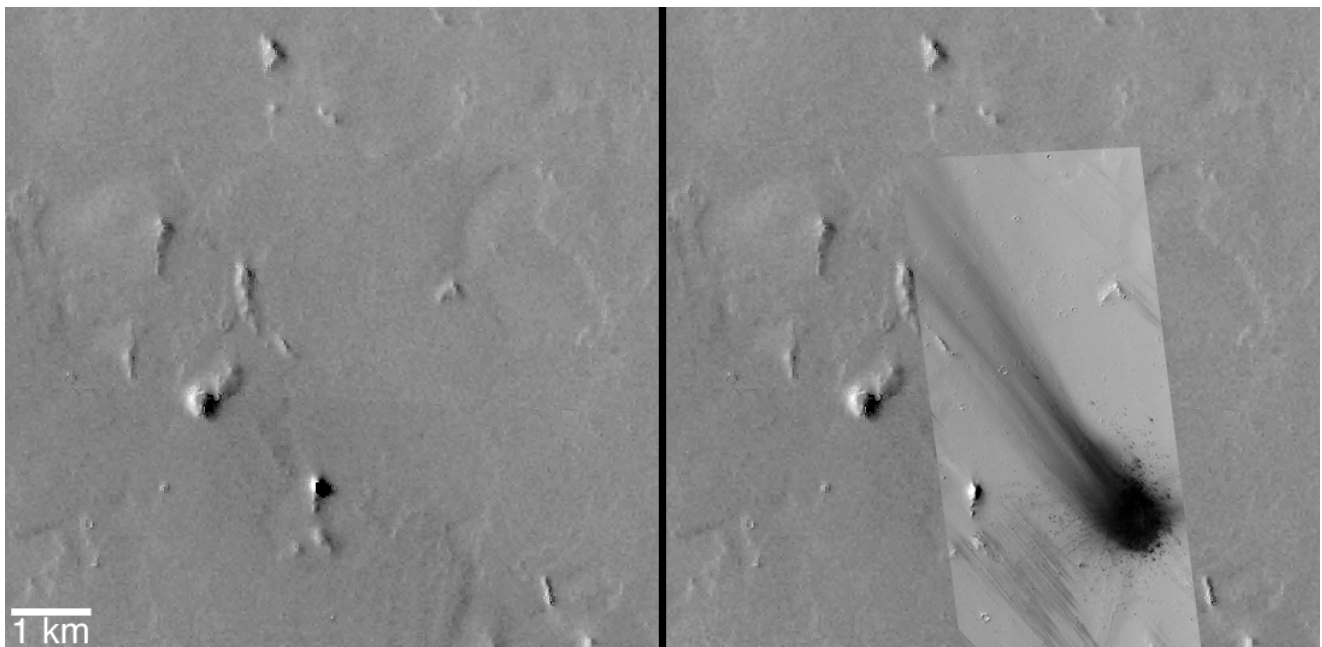
Notes:

The impact site consists of multiple craters of diameters: 16.8, 11.2, 11.5, 6.0, 6.0, and 6.0 ± 3.0 meters. A dark wind streak pointed toward the northwest emanates from the site, suggesting that disrupted dust was mobilized by wind sometime after the impact occurred.

Impact Site 20, 7.0°N, 112.2°W (page 3 of 3)



Orbiter images showing the site before (left) and after (right) the impact; the white circle indicates the impact location. At the left is a sub-frame of THEMIS daytime infrared image I16679016 (band 9; 17 September 2005). At the right is a sub-frame of MOC red wide angle image S15-02778 (26 February 2006). Each image is a simple cylindrical projection; north is up.



Orbiter images showing the site before (left) and after (right) the impact. At the left is a sub-frame of THEMIS VIS image V13297011 (13 December 2004); at the right is the same image, with MOC narrow angle image S18-00492 (6 May 2006) superimposed. Note the wind streak that formed downwind of the impact site. Each image is a simple cylindrical projection; north is up.