CHANDRAYAAN 3 AND PRAGYAN ROVER: TRAVERSE ANALYSIS. P. J. Stooke[1], [1]Institute for Earth and Space Exploration, University of Western Ontario, London, Ontario, Canada N6A 5B7, pjstooke@uwo.ca.

Introduction: India's first successful lunar landing mission, Chandrayaan 3, placed its lander Vikram on the Moon 20° from the south pole on 23 August 2023. It released its rover Pragyan which spent 11 days driving around the landing site. ISRO released a traverse map soon after the end of the lunar day. Several other maps of Pragyan's drive have been published, but they do not agree with each other or the ISRO map in many details. This poster presents results of a new analysis which attempted to match surface images with orbital data. Although gaps remain, many areas can now be mapped more confidently.

Data: This study uses Pragyan images released by ISRO, images taken by the lander's camera, and Chandrayaan 2 OHRC images of the landing site, currently the highest resolution available (c. 20-25 cm/pixel). I acknowledge and thank ISRO for making this material available via the Indian Space Science Data Centre (https://www.issdc.gov.in/). The lander apparently carried 4 cameras to provide a panoramic view of the landing site, which appear not to have worked, but a camera monitoring rover deployment did function during the surface mission.

Previous maps: All released maps [**1-5**] share a common form. The rover moved south from the lander and maneuvered in the vicinity of South Crater (Figure 1), then drove west to a point south of West Crater. The crater designations are from [**5**]. There it moved west, north and northeast to approach a crater rim, retraced its steps and then drove north to its final parking place. The final position is unambiguously revealed by OHRC and LRO images. The ISRO map and others published by Vadawale [**2, 3**], Vijayan [**4**] and Ghosh [**5**] show these drive segments but differ in details. The activities near South Crater are revealed in rover images of the tracks and small craters, and suggest an error in the ISRO map. Activities near West Crater can be positioned relative to small craters visible in OHRC images. The maps by the APXS team are revealed to be more accurate than the initial ISRO map.

South Crater activities: Pragyan drove south off the lander and stopped to charge its battery, then moved further south on 25 August. It took images facing south and east, and the east-facing images show a crater about 1 m across (crater A in Fig. 3) on the rim of the 9 m diameter South Crater. The small crater can only appear in an east-facing image if the rover is to its west, but the ISRO map shows the rover east of that small crater. Pragyan moved back north and then drove southeast towards the north rim of South Crater. It returned by an offset path to test traction and imaged these tracks, also viewing crater A. The ISRO map represents these new tracks as the first set of tracks and rotates the two excursions counterclockwise. Then Pragyan moved back to the lander, passed it and headed towards West Crater. Images along that route are difficult to relate to OHRC images and the map is still uncertain in that area.

West Crater activities: Pragyan drove to and around a 2 m diameter crater (crater B in Fig. 2). This crater and two smaller craters to its west are seen in several surface images and in OHRC images, unambiguously locating the craters and the drives around them. The ISRO map had the rover drive almost on the rim of crater B but surface images show Pragyan looping about 4 m further west before it returned to the crater on 31 August. On 1 September Pragyan drove around Crater B to approach the rim of a larger crater overlapped by West Crater, and viewed its interior. Finally it moved northeast along the rim of the larger crater and found a safe parking place, positioned to allow morning operations on the next lunar day if it survived the long night. LIBS and APXS were operated at almost every stop along the traverse.

Comparison of this new mapping with maps by the APXS team [**2, 3**] suggests that the APXS maps are more accurate than the original ISRO map. The map in [**5**] is very distorted.

This study of Pragyan images also made a horizon panorama possible. Images were taken for drive planning, not horizon mapping, but about 75% of the horizon was observed. A synthetic panorama from ACT Quickmap was used to position the visible sections of the panorama. This will be illustrated in the poster.

Acknowledgments: All data used here were made available by ISRO.

References: [**1**] ISRO map, https://x.com/isro/status/1697881823391711684 [**2**] Vadawale, S., ASET talk, Tata Institute, 19 October 2023. [**3**] Vadawale, S. *et al*., 2024. *Nature*, https://doi.org/10.1038/s41586-024-07870-7 . [**4**] Vijayan, S. *et al*., 2024. *Icarus*, https://doi.org/10.1016/j.icarus.2024.116329. [**5**] Ghosh, R. *et al.,* 2024. Int. Conf. Space Robotics.

Figure captions: Fig. 1: several versions of the Pragyan route map. Fig. 2: activities near West Crater. Fig. 3: activities near South Crater.

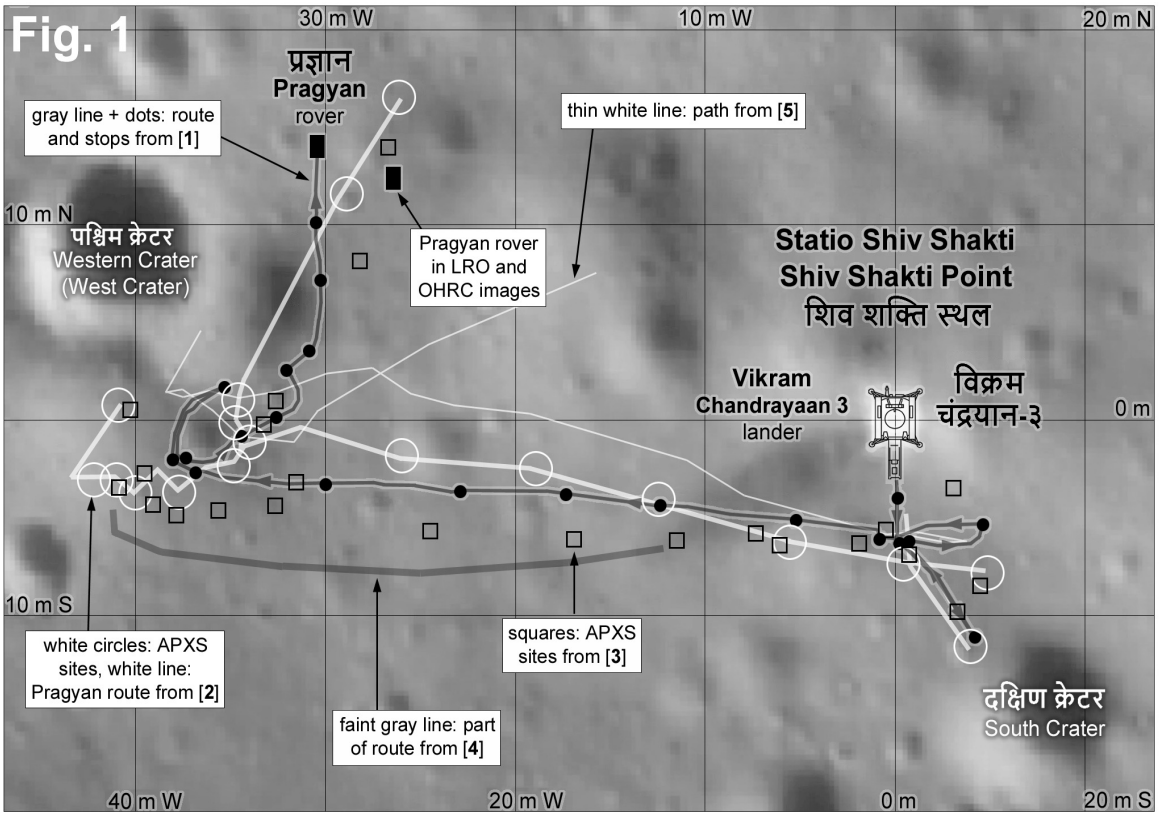
Fig. 1
30 m W
10 m W
20 m N
प्रज्ञान
Pragyan
rover
gray line + dots: route and stops from [1]
thin white line: path from [5]
10 m N
पश्चिम क्रेटर
Western Crater
(West Crater)
Pragyan rover in LRO and OHRC images
Statio Shiv Shakti
Shiv Shakti Point
शिव शक्ति स्थल
Vikram
Chandrayaan 3
lander
विक्रम
चंद्रयान-३
0 m
10 m S
white circles: APXS sites, white line: Pragyan route from [2]
squares: APXS sites from [3]
faint gray line: part of route from [4]
दक्षिण क्रेटर
South Crater
40 m W
20 m W
0 m
20 m S

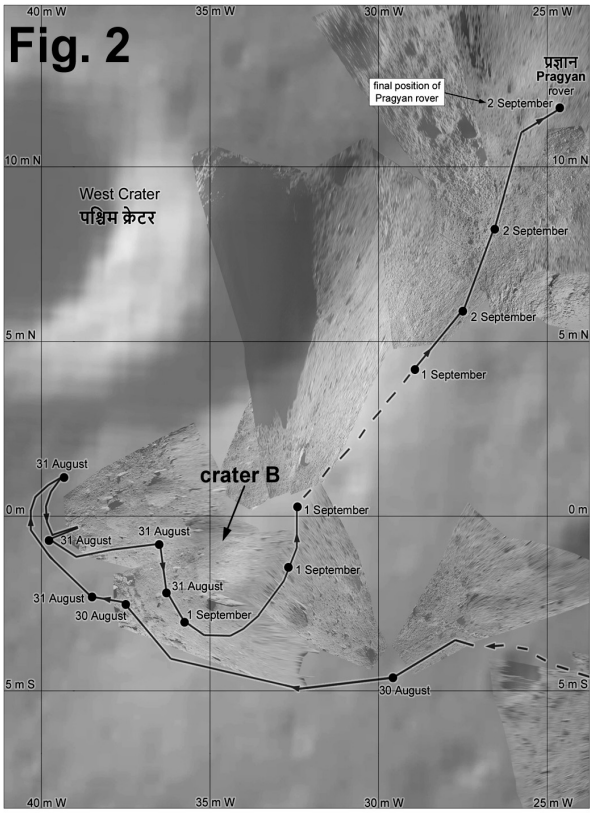
Fig. 2
40 m W
35 m W
30 m W
25 m W
प्रज्ञान
Pragyan
rover
final position of Pragyan rover
2 September
10 m N
West Crater
पश्चिम क्रेटर
2 September
2 September
5 m N
1 September
31 August
crater B
0 m
1 September
31 August
31 August
1 September
31 August
31 August
30 August
1 September
5 m S
30 August
40 m W
35 m W
30 m W
25 m W

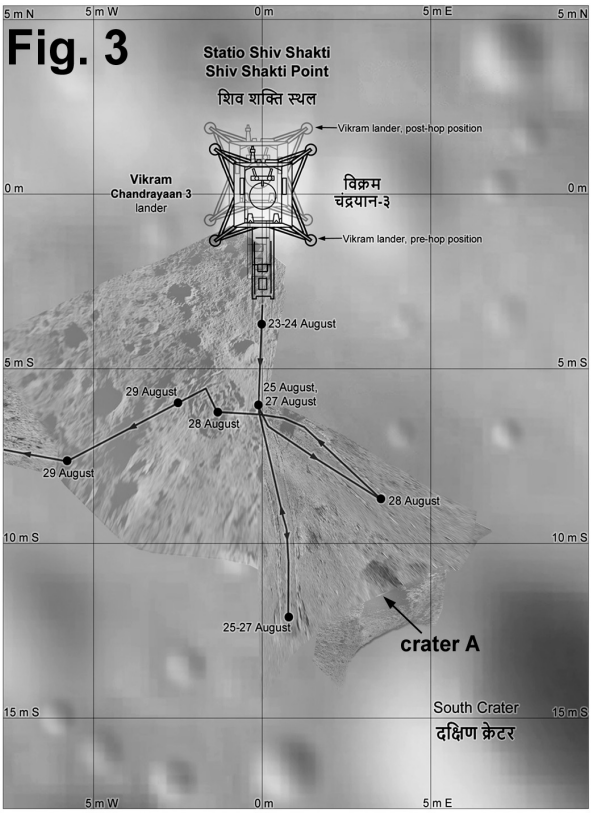
Fig. 3
5 m N
5 m W
0 m
5 m E
Statio Shiv Shakti
Shiv Shakti Point
शिव शक्ति स्थल
Vikram lander, post-hop position
Vikram
Chandrayaan-3
lander
विक्रम
चंद्रयान-३
0 m
Vikram lander, pre-hop position
23-24 August
5 m S
29 August
25 August,
27 August
28 August
29 August
28 August
10 m S
25-27 August
crater A
South Crater
दक्षिण क्रेटर
15 m S
5 m W
0 m
5 m E