

**INA-LIKE YOUNG VOLCANIC(?) STRUCTURES AS GOLDEN SPIKE SITES.** P. J. Stooke<sup>1</sup>, <sup>1</sup>Department of Geography and Centre for Planetary Science and Exploration, University of Western Ontario, London, Ontario, Canada N6A 5C2 (<http://publish.uwo.ca/~pjstooke>; pjstooke@uwo.ca).

**Introduction:** Ina, or D-Caldera, was discovered by Ewen Whitaker in Apollo 15 images [1]. Since then many similar but smaller features have been found across the nearside [2, 3]. They are thought to be young volcanic or outgassing features [4]. Any one would be a unique and valuable landing site, potentially revealing details of the last gasp of lunar volcanism. An ideal landing site should have more than one goal and type of material present, to maximize scientific value. I describe five Ina-like sites, identifying landing locations and Apollo 12-style (1000 m maximum distance from lander) walking traverses with two or more science goals each.

**Sites:** Refs [2] and [3] identify numerous sites like Ina, and here five of them in low- to mid-latitudes with two science goals each are described.

1: Ina itself (18.6° N, 5.3° E). Landing anywhere on its outer flank seems feasible, with access to the outer smooth deposits and surrounding mare, inner floor (dark and light facies) and interior mounds as well as the chance to inspect stratigraphy at the boundaries. A landing at the north-west corner also gives access to Imbrium ejecta (Fra Mauro Formation), within 1 km of the edge of Ina. This unit was sampled by Apollo 14 at a greater distance from the basin. Here it may include deeper target material.

2. Hyginus (7.7° N, 6.4° E). Many small Ina-like hollows occur inside Hyginus. A landing in the eastern floor gives access to several of these, plus large boulders which have fallen from the surrounding mare unit, and a chance to view mare stratigraphy in the upper walls with multispectral imaging. This would be the most visually dramatic of these sites, and an Apollo-style descent can be flown westwards down Rima Hyginus to avoid a very steep descent over the crater rim.

3. Cauchy dome (7.1° N, 37.5° E). This shallow dome south of Rima Cauchy in Mare Tranquillitatis has a complex Ina-like hollow and many smaller satellite pits. A landing on its west side permits investigation of the hollow and an EVA in the opposite direction to sample the surrounding mare basalts, younger than the dome itself.

4. Tobias Mayer caldera (14.9° N, 326.3° E). An ancient caldera surrounded by pyroclastics is also marked by many small Ina-like hollows. Several surround a crater at the northern end of the cluster, making this a good candidate site which also allows possible sampling of Copernicus ejecta where a ray passes just north of the site. Apollo 12 may have sampled

Copernicus ejecta but confirmation from a second site would be desirable. There is a small possibility of collecting Kepler ejecta in the regolith – a Kepler ray passes near the site. Aristarchus ejecta may also have been deposited in the vicinity.

5. Aristarchus ejecta (25.0° N, 313.3° E). A cluster of pits is clearly superposed on the ejecta deposit northeast of the crater and well within the limit of continuous ejecta. Aristarchus is one of the youngest large nearside craters, so its ejecta can be dated and its target material sampled, as well as the hollows themselves.

**References:** [1] Whitaker E., 1972. *Apollo 15 Prelim. Sci. Rep.*, NASA SP-289, p. 25-84 to 25-85. [2] Stooke, P. J. (2012) *LPSC 43*, Abstract #1011. [3] Braden, S. E. *et al.* (2013) *LPSC 44*, Abstract #2843. [4] Schultz P. H. *et al.* (2006) *Nature*, 444, 9 November 2006, doi:10.1038/nature05303.

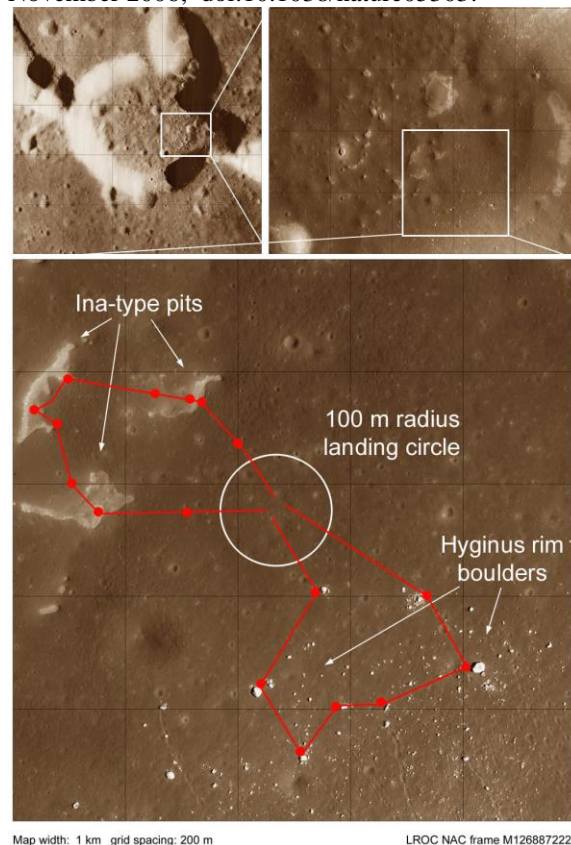


Figure 1. Hyginus site – bottom map 1 km across with 200 m grid. Two EVAs (red) visit Ina-like pits and large blocks from the upper walls of Hyginus, potentially sampling several layers of mare stratigraphy.