EXPLORING THE NEOTECTONICS ON THE MOON: THE YOUNG, ROCKY, DORSA ALDROVANDI WRINKLE RIDGE NORTHWEST OF TAURUS-LITTROW.

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Introduction: Lunar Reconnaissance Orbiter Camera (LROC) observations [1,2] have established that some of the small wrinkle ridges on the Moon are certainly Copernican, and possibly active within a few Ma or even active at present [2]. These wrinkle ridges show an excess abundance of meter-scale blocks in both LROC and Diviner rock abundance data [3-5] (Fig. 1b), which supports the idea that tectonic activity must be recent because the half-life of meter-scale blocks on the Moon is only 40-80 Ma [6]. The sharp topography [7] and that these wrinkle ridges cross-cut craters [1] (also Fig. 1c) speaks to their recent activity.

We argue here that these block-rich, young wrinkle ridges are interesting exploration targets. We first describe some objectives and concepts for exploring these landforms in a general sense, and then focus on one candidate landing area, Dorsa Aldrovandi.

Objectives for exploring neotectonic landforms: *Geophysics:* If these young wrinkle ridges are truly active [2], deployment of a (preferably long-lived) seismometer nearby would benefit from the natural seismic source and could directly target the wrinkle ridge to characterize its behavior. Additionally, given how sharp these neotectonics landforms are at the surface, their subsurface expression may be preserved and worth characterizing as well. Assessing this subsurface expression would require mobility and instruments capable of subsurface imaging (e.g., GPR or other techniques). Both seismic characterization and subsurface imaging would help address long-standing community goals of better understanding the Moon's interior structure.

Geology and Geochemistry: The large number of blocks at the surface of these landforms provides a nice opportunity to interrogate the geology and geochemistry of material that has only been exposed at the surface for a comparatively short amount of time (~10^7 years) and is thus likely to be relatively un-space-weathered as well as locally derived. A compositionally diverse suite of blocks could be examined where the ridge crosses geologic contacts (the mare/highlands boundary or multiple mare units). More compositional diversity would be possible if a rover capable of long traverses (100+ km) is available.

Lunar Evolution: Exploring the underlying cause for *why* these wrinkle ridges exist on the Moon and remain active and boulder-topped is also a worthwhile objective. Various models have been delineated [see 3 and refs therein]: (i) subsidence due to mare loading, (ii) orbital recession/despinning, (iii) global contraction, (iv) solid-body tides, (v) reactivation of deep-seated intrusions, or (vi) SPA-induced antipodal damage. How to test these different models *in situ* requires further thought, but many of these ideas have potential global-scale significance.

Specific landing area: A landing area near Aldrovandi Dorsa's northern edge (e.g. Fig. 1c) would enable access to mare as well as highland remnants of Le Monnier crater's rim. A traverse to the south would eventually reach other distinct mare units. An extended mission could return to the Apollo 17 landing region in Taurus-Littrow, with new capabilities to test the hypotheses developed over the last five decades.

Traceability: Studying lunar tectonics traces directly to objectives outlined in LEAG's ASM report and other community documents.

References: [1] Watters, T.R. et al. (2010), Science, 329, 936–940. [2] Watters, T.R. et al. (2019), Nat. Geo., 12, 411-417. [3] French, R.A. et al. (2019), JGR, 10.1029/2019JE006018 [4] Valantinas, A, Schultz, P.R. (2020), Geology, 48, 639-653. [5] Bandfield, J.L. et al. (2011), JGR, 116, E00H02. [6] Basilevsky, A.T., et al. (2013), PSS, 89, 118-126. [7] Fassett, C.I., Thomson, B.J. (2015), LPSC, 46, 1120.

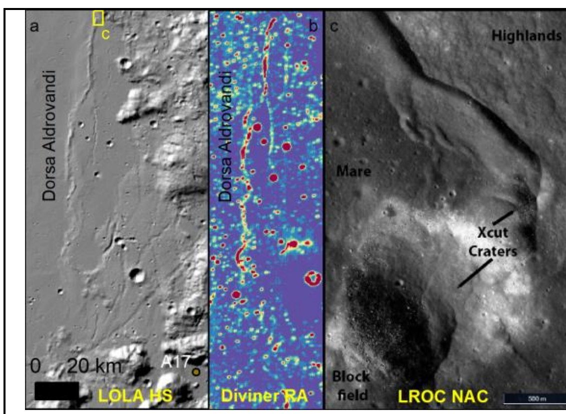

Figure 1. (a) The young, rocky wrinkle-ridge Dorsa Aldrovandi extends at its north from the mare-flood Le Monnier crater on the eastern rim of Serenitatis southward across several mare units. The Apollo 17 site in Taurus-Littrow is at the bottom right of (a). (b) The Diviner rock abundance [4] of the wrinkle-ridge is elevated over its entire length, which suggests recent activity. (c) Craters are cross-cut by the wrinkle-ridge (another argument for the ridge's youth). Blocks are exposed that could be examined with geology or geochemistry instruments during a long traverse. Detail here is centered at 29.1E, 25.7N.