ARAM CHAOS: A LONG LIVED SUBSURFACE AQUEOUS ENVIRONMENT WITH STRONG WATER RESOURCE POTENTIAL FOR HUMAN MISSIONS ON MARS

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EZ coordinates: 2° 25' N, 20° 02' W

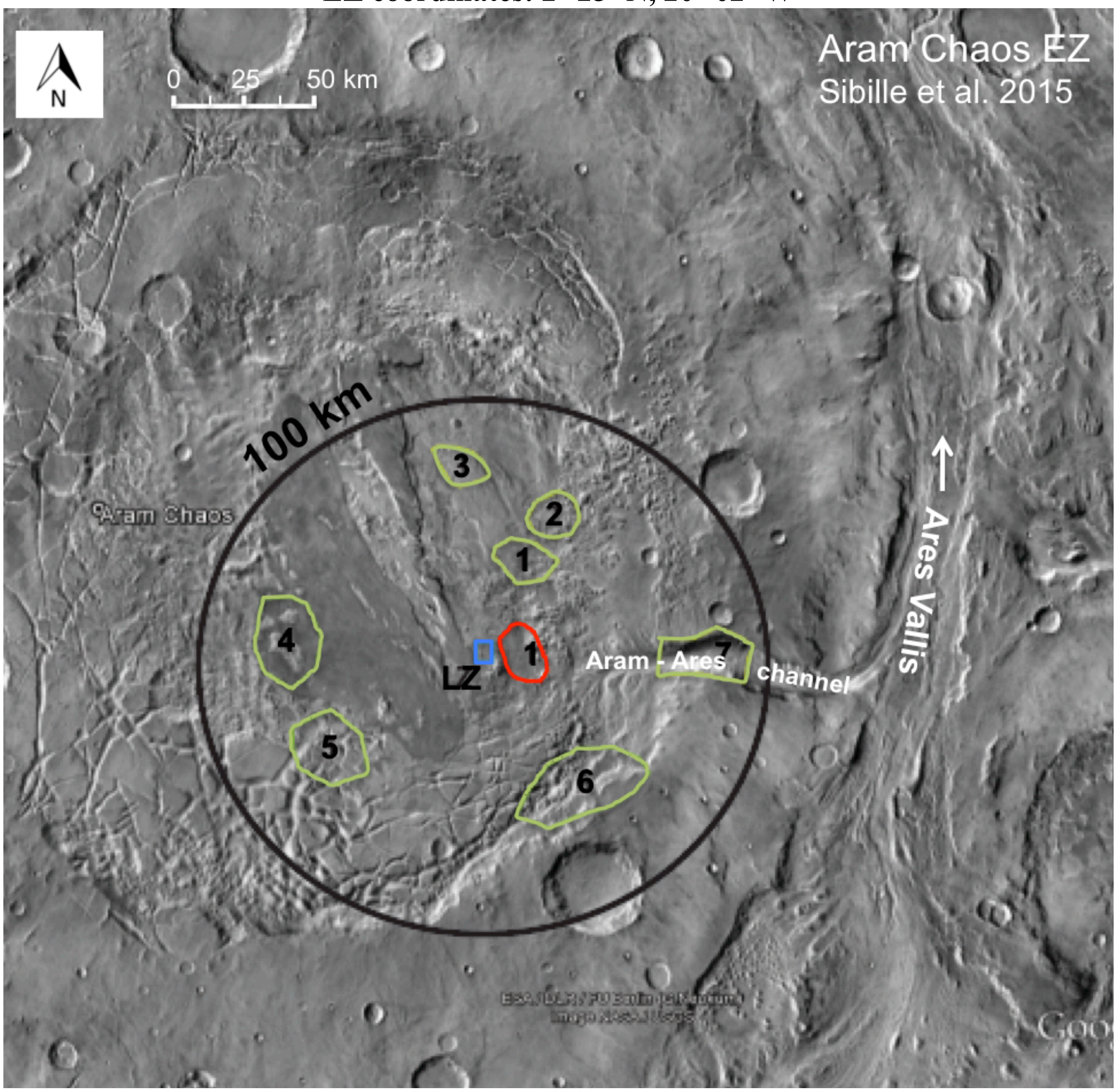

Figure 1. Aram Chaos Exploration Zone. Green circles indicate Science ROI's, red circles indicate Resource ROI's, and the blue square indicates a potential landing zone (LZ). ROI's #1-3 target hydrated minerals. ROI's #4-6 target different geologic units for understanding history of water and climate in the region. ROI #7 indicates potential exposure of Noachian terrain through incision of the Aram-Ares channel.

Aram Chaos, Mars is a crater 280 km in diameter with elevations ca. -2 to -3 km below datum that provides a compelling landing site for future human explorers as it features multiple scientific regions of interest (ROI) paired with a rich extensible Resource ROI that features poly-hydrated sulfates [1]. The geologic history of Aram Chaos suggests several past episodes of groundwater recharge and infilling by liquid water, ice, and other materials [1-3]. The creation of the fractured region with no known terrestrial equivalent may have been caused by melting of deep ice reservoirs that triggered the collapse of terrain followed by catastrophic water outflows over the region. Aram Chaos is of particular scientific interest because it is hypothesized that the chaotic terrain may be the source of water that contributed to the creation of nearby valleys such as Ares Vallis flowing toward Chryse Planitia. The liquid water was likely sourced as groundwater and therefore represents water derived from a protected subsurface environment making it a compelling astrobiological site [2]. The past history of water is also represented by high concentrations of hematite, Fe-oxyhydroxides, mono-hydrated and poly-hydrated sulfates [1, 2]. Poly-hydrated sulfates are likely to contain abundant water that evolves at temperatures below 500 C thus conferring Aram Chaos a potentially high value for early in-situ resource utilization ISRU [4]. The geologic history also calls for future prospecting of deep ice deposits and possibly liquid water via deep drilling.

The most recent stratigraphic units in the central part of Aram Chaos are not fractured, and are part of a dome-shaped formation that features bright, poorly consolidated material that contains both hydrated sulfates and ferric oxides according to OMEGA data [5]. These surface material characteristics are preliminary indications of their potential use in civil engineering activities that involve regolith moving and hauling, while further study is needed to assess traverse-ability challenges. The widespread distribution of sulfates is also of interest as a resource for the use of sulfur as a binding compound in regolith-based concrete for constructions. The terrain depressions caused by the rock fracturing events may challenge surface mobility but also suggest the possibility of using such natural features for additional shielding from space radiation and as emplacement of nuclear surface power reactors for the same reason. The high concentration of hematite (up to 16 %) in some of the smoother recent terrains of the central part of Aram Chaos [2] is a favorable attribute for metal extraction ISRU to create iron-based feedstock for in–situ fabrication of replacement parts or their repairs.

Preliminary data on Aram Chaos indicate that it offers a combination of many critical criteria for human missions to the surface of Mars: equatorial region at low MOLA, evidence of hydrated minerals over large areas and at high concentrations tied to historic evidence of liquid water over long periods.

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