**MARS-CONTEXT NON-OPHIOLITIC PROVENANCE OF SRI LANKA'S SERPENTINIZED AND CARBONATED ULTRAMAFIC ROCKS.** P.L. Dharmapriya[1] (prasannad@sci.pdn.ac.lk), R. Chandrajith[1], S.P.K. Malaviarachchi[1], H.A. Pitawala[1], S. Karunatillake[2], K.T.P. Jayaweera[1], H.K.D.V. Gunasekara[1], K. Sajeev[3], J. Wray[4], A. Sarbadhikari[5], L. Xiao[6], K. Anandakiththi[7], S. Perl[8], M. Melwani-Daswani[9], F. Rivera-Hernandez[4]. [1]Department of Geology, University of Peradeniya, Sri Lanka, [2]Geology & Geophysics, LSU, USA, [3]Center for Earth Science, Indian Institute of Science, Bangalore, India. [4]School of Earth and Atmospheric Sciences, Georgia Institute of Technology, USA. [5]Physical Research Laboratory, Ahmedabad, India, [6]China University of Geosciences, Wuhan, China. [7]Faculty of Humanities, University of Kelaniya, Sri Lanka. [8]Blue Marble Space Institute of Science, Washington, USA, [9]California Institute of Technology, USA.

**Introduction**: Serpentinization engenders habitability via paleo water-rock reactions and geothermal gradients [1]. However, provenance pathways, particularly for stagnant-lid tectonism on Mars [2], remain poorly understood. In this context, Sri Lanka's Serpentinite Bodies (LSB) yield a Mars analog with distinctly non-ophiolitic pathways [3,4]. Four litho-tectonic units constitute Lanka: the Highland Complex (HC), the Wanni Complex, the Vijayan Complex (VC), and the Kadugannawa Complex, formed during Gondwana's amalgamation [5,3]. Serpentinized ultramafic bodies occur along the HC and VC thrusts in southern Lanka (Ginigalpelessa-G, Yudhagannawa-Y, Ussangoda-U, Indikolapelessa-I, and Katupothe) and centrally in the HC at Rupaha-R [3]. Carbonation ($CO_2$-induced metasomatism of ultramafic source rock) is evident at R and I sites [3,6]. Here we present findings from our 2023 field expedition, a geo-planetary collaboration of Lankan, US, Indian, and Chinese institutions.

**Results**: Observations at R, G, I, U, and Y sites reveal extensive serpentinization of ultramafic source rocks. Nevertheless, olivine crystals occur at all LSB sites. Plagioclase phenocrysts are found in Ginigalpellessa and Indikolapellessa sites. Magnesite-dominated carbonate veins, ranging from a few millimeters to over 10 cm thick, form extensive networks in all serpentinite bodies. Site I has larger magnesite blocks (>1 m), while G showed quartz in magnesite veins. At sites G and U, chert veins range in size from a few millimeters to several centimeters, and large chert blocks are scattered in the serpentinite soil at U. Contacts between LSB and high-grade metamorphic rocks have been observed at R, I, and U sites. Cross-cutting granitic to syenitic pegmatites occur at all sites.

Petrography and electron probe microanalysis reveal relict olivine at all locations and relict chromite spinels [Cr# (Cr/(Cr+Al)) from 60–85] at G, I, and U sites. Serpentine (Mg-rich) often exhibits reticulated textures after olivine. Disseminated magnesite is identified with serpentine ± olivine. Host metamorphic rocks from sites R, I, and U preserve peak metamorphic and some retrograde mineral assemblages without apparent alteration by hydrothermal and carbonate metasomatism.

**Discussion**: Our observations suggest that the LSB and carbonated ultramafic bodies exhibit regionally consistent mineralogical signatures and serpentinization-carbonation pathways. Ultramafic protoliths exposed to intense hydrothermal fluid-derived metasomatism underwent extensive serpentinization and interaction with $CO_2$-rich fluids. At R, I, and U sites, preserved peak metamorphic assemblages indicate limited host-rock interaction with hydrothermal and $CO_{2(aq)}$ fluids that serpentinized the ultramafic source rocks. Serpentinization followed carbonation, forming magnesite via chemical reactions of Mg-serpentine + $CO_{2(aq)}$ → magnesite + quartz + $H_2O$ [7]. Chert veins are attributable to dissolved $SiO_2$. Meanwhile, Mg-serpentines and magnesite co-occur in Nili Fossae and Jezero Crater on Mars [8,9]. Olivine and alteration products serpentine and magnesite are also documented, including chromite in Martian meteorites [10,11]. LSB findings constrain Mg-rich serpentinization pathways in the non-ophiolitic settings of Mars, perhaps also enhancing $Mg^{+2}$ availability for extensive Mg-sulfate strata. Our upcoming works will characterize LSB's fluid reactive transport, geothermal gradients, and redox conditions to constrain Martian counterparts.

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