ARTEMIS-ENABLED LUNAR ELEMENTAL ABUNDANCE APXS INVESTIGATION. A. Shaw[1], R. Gellert[2], D. Hiemstra[1], I. Aslam[1], D. Buckland[1], C. Dickinson[1], P. Fulford[1], M. McCraig[2], and M. Schmidt[4], [1]MDA Corporation (amy.shaw@mdacorporation.com), [2]University of Guelph (rgellert@uoguelph.ca), [4]Brock University.

Introduction: The integration of science instrumentation into the Artemis surface mission framework provides unique science opportunities. The Artemis Program gives the lunar exploration community an opportunity to gain tremendous information about the lunar surface composition, and in particular its elemental abundance and how the elemental constituents vary with geologic context.

APXS for Lunar Science: Using APXS (Alpha-Particle X-Ray Spectrometer [1, Fig. 1]) during the course of the Artemis surface exploration program is important. Elemental abundance is a key piece of scientific information [Fig. 2] that leads to insights into the history of planetary surfaces as well as current processes [2]. There are several potential use cases, but two we will highlight here are:

1. APXS as part of a surface telerobotics rover
2. APXS manual deployment by astronauts

Fig. 1: APXS sensor head on the robotic arm of the Mars Science Laboratory (MSL) Curiosity Rover. Image Credit: NASA.

APXS as part of a Surface Telerobotics Rover: To maximize the science return of a crew mission, it will be important to have robotic scientific triage to identify the most interesting sites for astronauts to investigate, since astronauts will have limited time on the surface. APXS could be used as part of a telerobotic rover science suite to identify the regions of high scientific priority for the astronauts to investigate.

APXS manual deployment by astronauts: Lunar terrain modification can occur in a crew mission in ways that would not happen with a single robotic rover, and a crew mission would offer more flexibility in use case than with certain other types of mission. An astronaut could decide in real time how to use the APXS instrument. The astronaut would scan the surrounding terrain and identify locations of interest. They could then overturn small rocks and place APXS down at a location that has been previously sheltered from alteration, or they could obtain depth profiles of elemental abundance in regolith by scooping surface regolith out and placing APXS at various depths.

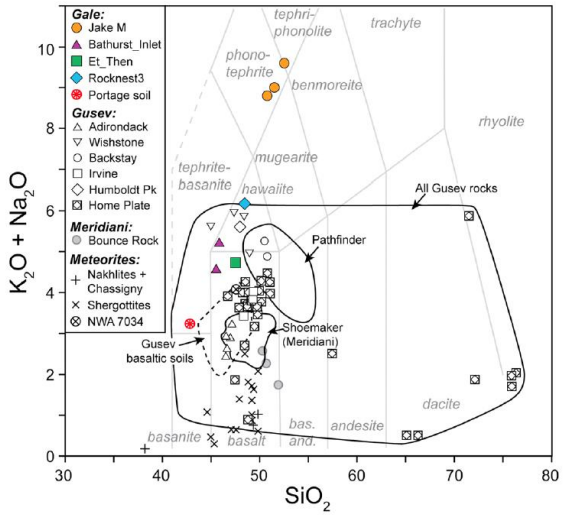

Fig. 2: Example of APXS results on Mars [2].

APXS for Resource Investigation: The elemental abundance information provided by APXS will be valuable for evaluating available in-situ resources. APXS can tell investigators the elemental makeup [1] of the materials available for future resource utilization. Of particular importance is the information APXS would return on the abundance of iron and aluminum. APXS would also return information on Mg, Si, Ca, among other elements.

APXS Heritage: APXS is currently in operation on the surface of Mars as part of the Mars Curiosity Rover. MDA is the prime contractor for the instrument, CSA is managing the Canadian participation, and the University of Guelph is leading the APXS Science Team.

APXS has also flown on the Mars Exploration Rovers Spirit and Opportunity, as well as on the Mars Pathfinder mission.

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References:

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[2] Schmidt M. et al. (2014) *JGRe Planets*, Vol. 119, 64-81, doi:10.1002/2013JE004481.