



Smithsonian
Museum Conservation Institute

Project Summary

MCI #6079

LUNAR DUST ON APOLLO SPACESUIT SYSTEMS

Mary Ballard, Lynn Brostoff, Roland Cunningham, & Mel Wachowiak

Summary by Mary W. Ballard, Senior Textiles Conservator

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Robert Koestler, the Director of MCI was contacted by an enterprising intern at the NASA John H. Glenn Research Center, Polymers Division, Cleveland, Ohio, named Vasana Maneeratana, who inquired about the use of MCI facilities to study the deterioration of the surface and fittings of Apollo spacesuits by lunar dust. She had contacted Amanda Young, curator of the relevant spacesuits; the curator was reluctant to release or loan the spacesuits for study to NASA –Cleveland or to NASA-Houston. After concurrence by Amanda Young and some discussion two groups of NASA scientists, under the aegis of Joe Kosmo, senior project engineer for spacesuit design, all came to MCI to review Charles Duke's Apollo 16 pressure glove and Harrison Schmitt's Apollo 17 spacesuit, glove assembly, and lunar boot.

Mel Wachowiak provided extensive optical microscopic images, Ron Cunningham was able to use the new SEM low vacuum imaging for the glove and to provide a Beta radiograph of the same glove. Lynn Brostoff, carried out an extensive XRF analysis as directed by John Lindsay, John Feigherty (USRA Houston, TX); Joe Kosmo, Roy Christoffersen, Sarah K. Noble (NASA Johnson Space Center, Houston TX), and Mary Ann Meador and Ann P. Over (NASA Glenn Space Center, Cleveland, OH).

This work occurred over two visits, first in November, 2006 and second, after the new SEM arrived in April, 2007. In addition, there were conference telephone calls to discuss SEM results. The collaborative work resulted in an internal poster for NASA and also an article "Lunar Dust Effect on Spacesuit Systems: Insights from Apollo Spacesuits," authored by NASA scientists, Amanda Young, and Lynn Brostoff (April 2009). Copies of the data generated from microscopy, X-radiography and XRD, as well as internal reports and related publications, are archived at the Smithsonian's Museum Conservation Institute in Suitland, MD, under project #6079.



References to Lunar Dust for this work provided by V. Maneeratana:

- 1) "Space Suit Evolution: From Custom Tailored to Off-the-Rack" ILC Dover, Inc. 1994.

2) "MSC06805 Apollo 16 Technical Crew Debriefing, May 5, 1972" NASA/TM-2005-213610, pp53-66



3) "Appendix" NASA/TM-2005-213610:

MSC00171 Apollo 11 Mission Report November, 1969, 15-17.

MSC01855 Apollo 12 Mission Report March 1970, 19-25.

Apollo 12 Technical Crew Debriefing December 1, 1969, 27-31.

MSC04112 Apollo 14 Mission Report May, 1971, 33-35.

Apollo 14 Technical Crew Debriefing February 17, 1971, 37-39

MSC 05162 Apollo 15 Mission Report, December 1971, 41-43.

MSC04561 Apollo 15 Technical Crew Debriefing, August 14, 1971, 43-47.

MSC07230 Apollo 16 Mission Report, August, 1972, 49-52.

4) Hodgson, Edward, "The Chameleon Suit—A Liberated Future for Space explorers," *Gravitational and Space Biology Bulletin* 16 (2) June 2003:107-120.

5) Papike, J., L. Taylor, and S. Simon, "Lunar Minerals" *Lunar Sourcebook: A user's guide to the moon* ed. by G.H. Heiken, D.T. Vaniman, and B.M. French. Cambridge: Cambridge University Press, 1991.

6) Schmitt, R.A., H. Wakia, P. Rey. "Abundance of 30 Elements in Lunar Rocks, Soil, and Core Samples," *Science*, vol 167 Jan. 30, 1970:512-515.

7) Notes taken by James R. Gaier, Electro –Physics Branch, NASA Glenn Research Center, Cleveland OH about visit to Garber Facility Feb 18, 2005

8) Gaier, J.R. "The Effects of Lunar Dust on EVA Systems During the Apollo Missions" NASA/TM-2005-213610

9) Young, L.A. and A.J. Young, "The Preservation, Storage, and Display of Spacesuits," *Collections Care (Smithsonian National Air and Space Museum)* Report Number 5 December 2001.



November 2006: seated from left: Mel Wachowiak, Amanda Young, Roy Christoffersen, Joe Kosmo, Ann Over. Standing from left: Paula Depriest, Bob Koestler, Jeff Speakman, Mary Ballard, John Feighery, Mary Ann Meador, Sarah Noble, John Lindsay.