Apollo 11 Sample Degradation History

There are two basic areas of sample degradation to be considered in Apollo 11: 1) Sample contamination during collection and transportation of samples back to earth; and, 2) Laboratory contamination during original processing.

Tools used on the lunar surface for sample collection (hammer, tongs, etc.) were stored in two different configurations in the Modularized Equipment Storage Assembly (MESA). Core tubes, solar wind experiment, and Teflon storage and collection bags, were cleaned to high standards (Apollo 11, 12 & 13 Organic Contamination Monitoring History) MSC-04350 and vacuum sealed in the ALSRC containers at the Lunar Receiving Laboratory. All other large tools (scoops, tongs, etc.) were cleaned to spacecraft cleaning levels. These levels were reported as being equivalent to laboratory cleaning levels used on LRL tools (personal conversation with W.A. Parkan). However, all tools not sealed in the ALSRC were hand checked in a clean room environment, prior to loading into the MESA. At this time it is possible that the hand tools could have been handled by someone without gloves.

On the lunar surface, the astronauts probably handled a few of the larger samples without using any tools. EVA suits worn by Armstrong and Aldrin were cleaned only to a visual cleaning requirement. This meant that they were probably the "dirtiest" item to come in contact with any samples at that point in the mission. Spacesuit out-gassing may have been another minor contributor to surface contamination. Lunar surface contamination from exhaust emissions of the lunar module may have occurred during landing.

Since all rocks and soils were collected in a small radius around the LEM, it is possible that residue from the descent engine contaminated certain surface samples. This possibility has been studied and documented, (Murphy et al., 1970). However, no direct conclusions were reached.

In the LRL, cabinets in which lunar samples were to be processed were cleaned with alcohol and flushed with Freon. This was repeated several times to ensure no biological contamination of the samples. During the quarantine period, containers or tools transferred into any cabinet system in the LRL were flushed with peracitic acid and were put through a dry heat sterilization process. The amount of heating was not any different from the daytime temperatures on the moon. No cases were recorded of peracitic acid leaking through a container onto a sample. The samples came in contact with Teflon, aluminum, and stainless steel, and were exposed to indium (used for sealing containers) and molybdenum disulfide (used as a lubricant). In addition to this, samples processed in PCTL were exposed to open Mettler balances, and immersion oils used in petrographic work. Samples in SPL were sawed in open air.

Many samples repackaged during re-examination had been packaged in Bel-Art products, (polyethylene and polystyrene) which were labeled with gummed labels, and written on with ball point pens. These products, if exposed to samples, could have added greatly to sample contamination.

In the present SSPL, samples only come in contact with stainless steel, Teflon, and aluminum. Xylan is used as a lubricant in the place of molybdenum disulfide.

During this re-examination, samples were re-packaged and old packaging was noted in the data packs.

All tools which touch samples, are cleaned to a CP-7* level. Most containers which samples are stored in, are also cleaned to a CP-7* level. All processing cabinets used for lunar samples, are cleaned to a CP-1* level.

**Contamination Control Procedures (MSC-03243)*