# SAMPLE COLLECTING TOOLS AND CONTAINERS

The Apollo 11 crewmembers used the following sample-collection tools and containers to obtain samples of the lunar surface. The tools were designed of material rugged enough to do the job, yet light enough to conform to the weight and space limitations of the lunar module stowage area. The pressurized space suit also had to be considered; therefore, the tools were designed with quick-disconnect fittings to enable the crewman to attach or detach components with a minimum difficulty. Knurled or roughened areas were provided on many tools to improve the crewman's grasp. Prime consideration was given to the selection of the metals and lubricants used in the construction of the tools to avoid elements and isotopes that might contribute to serious geochemical contamination (such as lead, strontium, etc.).

The two Apollo lunar sample return containers (ALSRC, Fig. 3) were portable, sealable aluminum containers; each container weighed approximately 6.8 kilograms, measured 20.3X26.7X44.5 centimeters and had a capacity of 0.023 cubic meters. They were lined with York stainless steel mesh and Teflon. Prior to the lunar landing, these containers housed the core tubes and other related equipment. On the lunar surface, the astronauts opened, filled, and closed the containers. Three seals on the hinged lids (one of indium and two of Viton) preserved the samples in the vacuum environment during transportation back to the Lunar Receiving Laboratory. Upon return to the LRL, readings were taken to determine the atmospheric pressure inside the sample container. Both ALSRC's had internal pressures of 170 microns; proof a substantial negative pressure was maintained during transfer of samples from the lunar surface back to earth.

The hammer (Fig. 4) was made of tool steel suitable for impact use. The head was coated with vacuum-deposited aluminum to minimize solar heating. The handle was offset slightly so that the astronaut could strike a square blow despite the encumbrance of his pressurized space suit. The end of the hammerhead opposite the striking surface was shaped for use as a pick or chisel; with the extension handle attached, it could be used solely for driving the core tubes into the surface by striking the end of the extension handle.

The tongs (Fig. 5) were made of anodized aluminum (No. 606 T6) and were used to retrieve samples of pebbles size and larger. This tool consisted of a set of opposed, spring-loaded fingers attached to a 66-centimeter handle. The tongs were operated by squeezing the handles to actuate the cable that opened the fingers.

The extension handle (Fig. 6) was used to increase the astronaut's reach by adding 58.4 centimeters of handle length to various tools. The lower end of the extension handle had a quick-disconnect mount and lock for tool attachment. The upper end was fitted with a sliding tee handle to facilitate any torquing operations.

The large scoop (Fig. 7) was made of anodized aluminum (No. 6061 T6) and had an appearance similar to the bucket of a power shovel. The scoop and its handle measured 39.4 centimeters, and could be extended an additional 58.4 centimeters

using the extension handle. The large scoop was used in the lunar extravehicular activity to collect the bulk sample.

Two core tubes (Fig. 8) were made of anodized aluminum (No. 6061 T6) and were used to obtain samples from the lunar surface in a manner such that any possible near-surface stratigraphy would be preserved. The core tubes are 41.3 centimeters long and would be attached to the extension handle. Two tubes, each containing a sample, were capped and placed in the documented sample return container.

The contingency sample container (Fig. 9) consisted of a small Teflon bag, resembling an oversized sandwich bag, and a jointed aluminum handle approximately 84.5 centimeters long in its fixed extended position. The bag measured 5.2X12.7X17.8 centimeters. The contingency sample container was used to obtain a lunar sample during the early stages of the extravehicular activity. This sample was intended to provide at least a small amount of lunar material for return to earth if it were necessary to terminate the surface portion of the mission early.

Fig. 3: Sample Return Container (ALSRC) with Rocks S69-45002

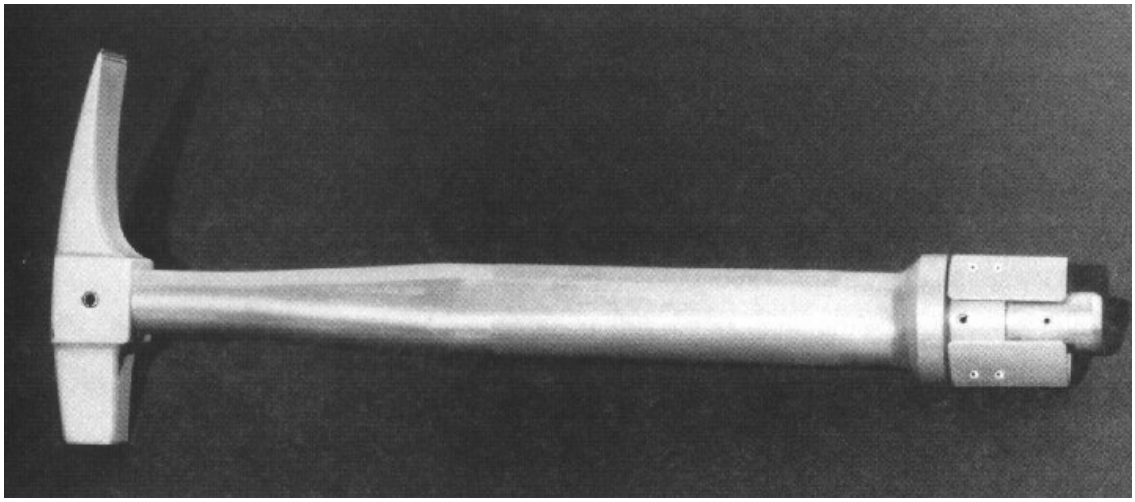

Figure 4: Hammer S69-31847

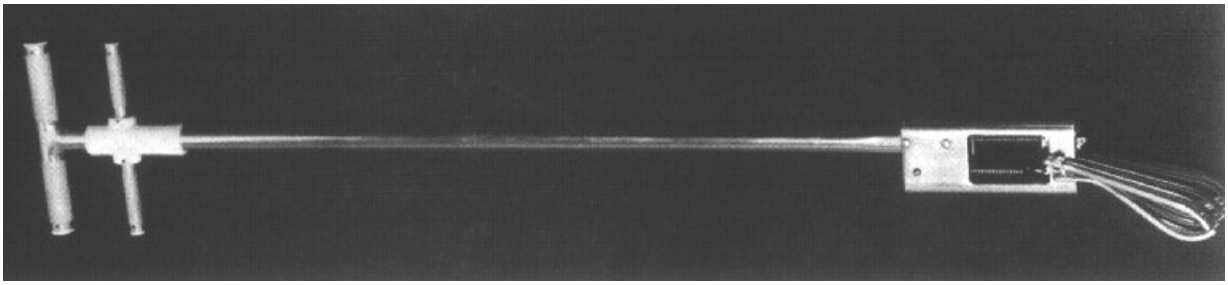

Figure 5: Tongs S69-31855

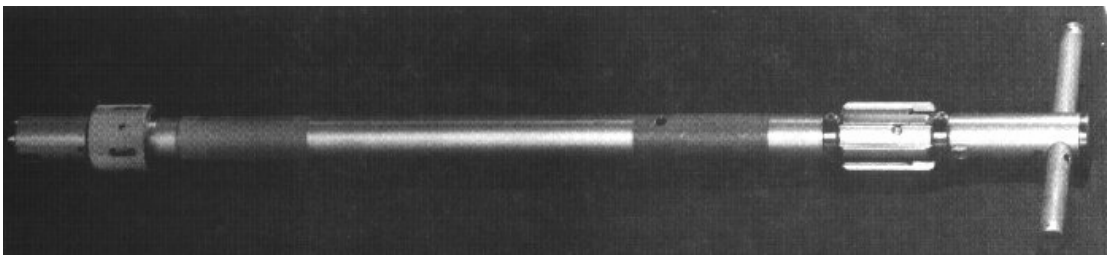

Figure 6: Extension Handle

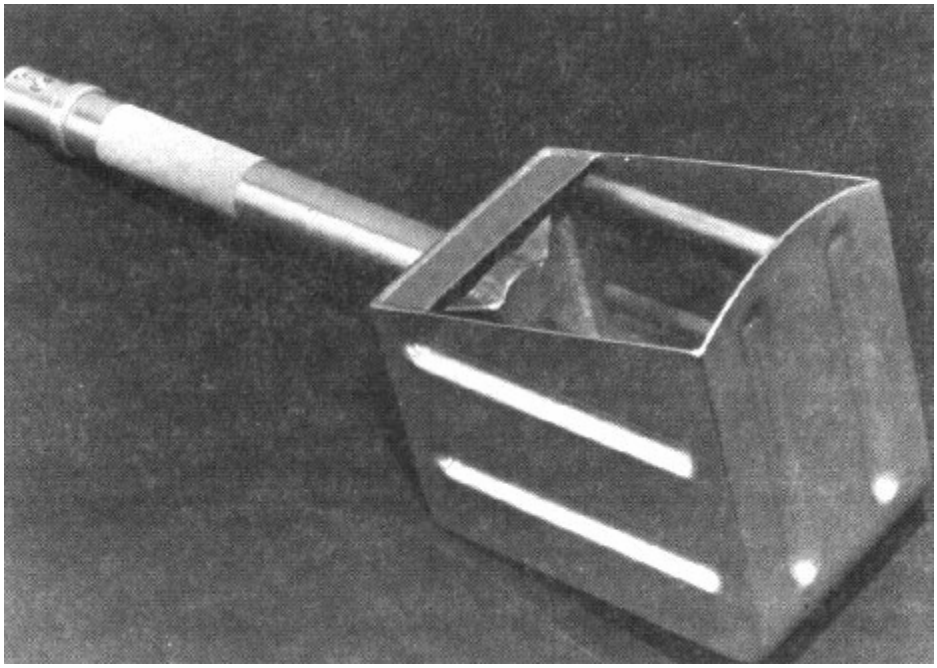

Figure 7:Large scoop  S69-31846

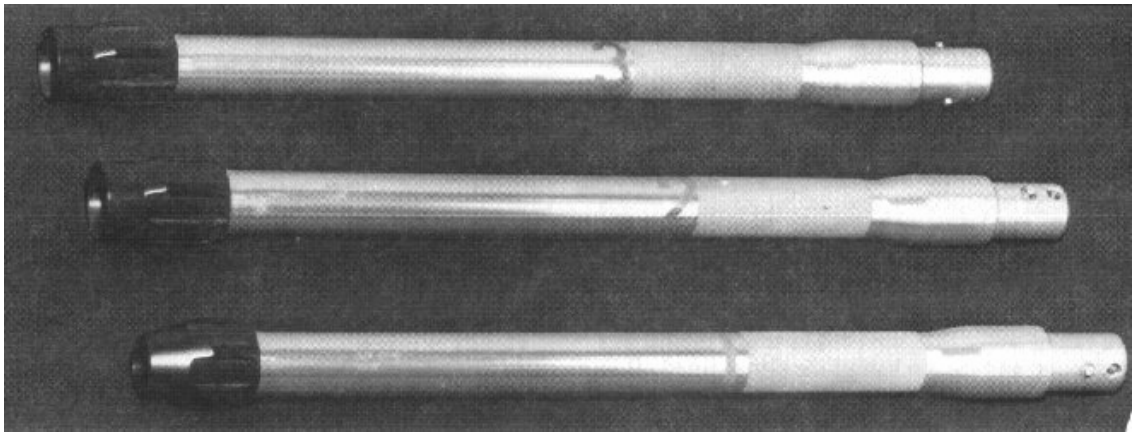

Fig. 8: Core Tube  S69-31856
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Fig. 9: Contingency Sampler  S69-31048