SPECIAL, UNOPENED LUNAR SAMPLES: ANOTHER WAY TO STUDY LUNAR VOLATILES. G. E. Lofgren, Code KT, NASA-JSC, Houston, TX 77058, gary.e.lofgren@nasa.gov.

Introduction: During the last three Apollo missions several samples were collected and immediately placed in vacuum tight-containers. Three of these samples have never been opened and, together with 2 samples not placed in vacuum, are the only lunar samples that have not been examined, Table 1. There were, however, samples collected immediately adjacent to some of these samples that have been studied. Because there was nothing notable about these samples, there was no compelling reason to open them, and it was decided that they be preserved for future studies. With the increased interest in volatiles on the moon, perhaps that time has come.

Sample Description: The vacuum samples were collected in stainless steel containers that have an indium/silver alloy seal (Fig.1). A stainless steel knife edge is pressed into

Table 1: Unopened vacuum containers and core tubes [2]

Sample Number	Container	Close by sample*	Amt. of sample
15014	SESC	15030	333 g
69001	CVSC	69940	558 g
73001	CVSC	none	809 g
73002	Drive tube	none	429 g
70012	Drive tube	none	434 g

Indium alloy to create the seal [1]. The 5 containers collected are listed in Table 1. The drive tube samples are stored in Teflon bags. The SESC (Special Environmental Sample Container) vacuum container, 15014 has no additional vacuum container and is sealed in Teflon bags. The SESC containers that were opened immediately upon return of the

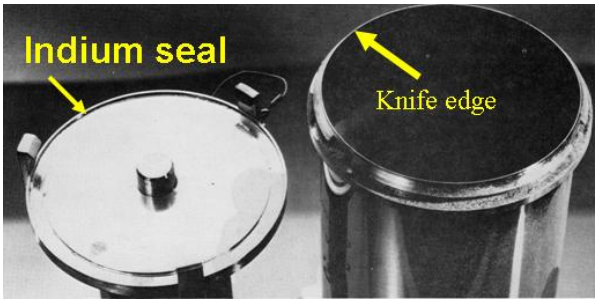

Figure 1. The seal for the SESC vacuum containers used on to contain samples in vacuum. An indium/silver alloy is embedded in the lid. The knife edge of the stainless steel container is forced into the seal material as the lid is tightened onto the container.

samples from the Moon appeared to seal with the exception of the SESC on Apollo 16 where a SS wire that connects the lid to the can was inadvertently caught up in the seal. The CVSC (Core Vacuum Special Container) container is an extended SESC that holds a standard drive core tube section. A section of a drive tube was placed in the container on the lunar surface by the Astronauts. A-16 and 17 Sample Return Containers containing 69003 and 73001 had a pressures of 89 and 28 microns Hg respectively prior to opening in the nitrogen processing cabinets [2,3]. 69001 is a single drive tube that sampled to a depth of 27.5 cm while 73001 is the upper section of a double drive tube that sampled to a depth of 77 cm, depth of 73001 is approximately 27 cm [4]..

The CVSC containers 73001 and 69001 appeared to be sealed based on their outward appearance and were placed in additional vacuum containers immediately upon return to the Lunar Receiving Laboratory. These containers have a standard, high quality vacuum seal to help maintain the vacuum and prevent contamination. It is not anticipated that the CVSC containers still retain the level of vacuum that exists on the Moon. Analyses of the atmosphere in the SRC's before opening showed no evidence of terrestrial atmosphere (Bogard, personnel communication). We will not know for sure the status of the seals until the containers are opened.

The "close by" column (Table 1) gives the number of sample collected immediately adjacent to the samples sealed in the SESC or CVSC containers. The "close by" samples can be considered as nearly identical to the samples sealed in vacuum.

Discussion: There are 2 important questions. Can these samples contribute to our understanding of volatiles on the moon and, if so, how do we open these containers and extract the samples so as to preserve any information they contain about volatiles.

It is important to note the nature of the sample collection process. The SESC sample was scooped from the regolith and poured into the SESC container. In the video of the sample collection, is it evident that the finest fraction was winnowed away as the sample was poured from the scoop into the SESC container. In contrast the drive tube samples have the best chance of having preserved volatiles because the sample was forced into the tube with a minimum disturbance.

Assuming the core tubes are the most pristine lunar samples that remain in the Apollo Collection and have the best chance of containing indigenous volatiles, how do we open the containers and extract the samples in a manner to best preserve them.

Curation currently does not have a vacuum facility that would allow us to open the samples in a vacuum. If it is a requirement that the samples be opened in a vacuum there are two options. Curation will need to acquire a vacuum facility or it will need to gain access to such a facility for a limited time for this purpose. If processing in our nitrogen cabinets is deemed appropriate, we can proceed with sample allocation. Whatever atmosphere is used, the next task would be to devise a technique to sample the material in the core in a manner to best preserve the volatiles for study.

References: [1] Allton J. A. (1989) JSC 23454, NASA Johnson Space Center, Houston, TX 77058. [2] Apollo 16 Lunar Sample Information Catalog (1972) MSC 03210 [3] Apollo 17 Lunar Sample Information Catalog (1973) MSC 03211 [4] Heiken G. H. et al. (1991) Lunar Sourcebook, Cambridge University Press, New York, p 328.