DEVELOPMENT OF A FINE-PARTICLE SPECTRAL LIBRARY.

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Introduction: Previous studies have shown that spectra acquired under vacuum conditions vary from traditional spectra acquired under ~1 atm, especially for fine particle sizes due to increased thermal gradients, and over wide temperature ranges that cause unit cell volume changes in minerals [e.g., 1-4]. Dusty, airless solar system bodies (asteroids, Martian moons, Moon) will be better studied using a diverse collection of laboratory spectra acquired under vacuum conditions over a wide range of temperatures.

Samples Measured at Collaborating Labs: The TREX SSERVI node (trex.psi.edu) is developing a comprehensive spectral library for airless bodies that will focus on ***fine-grained (<10 μm)*** planetary materials measured over *ultraviolet, visible/near-infrared, and mid-infrared* ***(UV-VNIR-MIR)*** wavelengths under environmental conditions that mimic the surfaces of airless targets *(in vacuum and at various temperatures from ~ -180 to +300 °C,* when possible). We will present the spectra of a suite of terrestrial minerals (Table 1) (for our project's end-members, and eventual mineral mixtures and select mineral-ice mixtures) collected at collaborating laboratories (Table 2).

Table 1. Terrestrial minerals to be measured.

MINERALS:	Pyrite
Forsterite Globe SSERVI*	CaS (oldhamite)
Forsterite SC SSERVI*	Fe metal <10 um
Bytownite SSERVI*	Graphite 7-11 um
Labradorite SSERVI*	Spinel ARSAA
Diopside SSERVI*	Nontronite (NAu-2)
Augite SSERVI*	Palygorskite (PFI-1)
Albite (AL-I)	Hectorite (SHCa-1)
Anorthite (Anorthosite AN-G)	Na-montmorillonite (SWy-3)
Labradorite ARSAA	Ca-montmorillonite (STx-1b)
Fayalite	Kaolinite (KGa-1b)
Pigeonite	Serpentine (UB-N)
Enstatite	Serpentine (SMS-16)
Hematite 3 nm	Phlogopite Mica-Mg
Hematite <5 um	Zinnwaldite (ZW-C)
Ilmenite	Amorphous C

*Samples being used by several SSERVI teams for cross-SSERVI collaborations & science linkages [5,6].

Additional Samples: We will study *meteorite & lunar samples* in subsequent yrs of the TREX project.

Table 2. TREX laboratories.

Lab	**Measurement**	**Wavelength**	**P, T**
DLR	Reflect.	0.18 - 20 um	0.7 mbar; ambient T
	Emission	3 – 20 um	Purged air; 30-200C
	Reflect.	0.7 – 300 um	0.7 mbar; ambient T
	Emission	0.7 – 300 um	0.7 mbar; 50-300C
Mount Holyoke	Raman	3 - 33 um	Ambient
	Mossbau.	14.4 KeV	Ambient
PSI	Reflect.	0.11 – 0.22 um	<mbar; 77K
	Reflect.	0.18 – 0.88 um	77 – 490K; <mbar to 1.5 bar
	Reflect.	0.35 to 2.5 um	77 – 490K; <mbar to 1.5 bar
	Reflect. (future)	1.5 to 50+ um	77 – 490K; <mbar to 1.5 bar
Univ. Winnipeg	Reflect.	0.16 – 0.4 um	Ambient
	Reflect.	0.35 – 2.5 um	Ambient
	Reflect. (future)	1.6 – 200 um	<mbar; ambient T
LASP	Reflect.	0.12 to 0.6 um	<mbar P; 90K for ices
Univ. Illinois	Refl.; Irradiation	0.35 – 2.5 um	<mbar P; 77-900K
NASA-JSC	Impact sims	n/a	n/a

Support of Other Projects: Our UV-VNIR-MIR spectra will be utilized for other TREX science applications (lunar surface, small bodies, field work) and be archived for public use.

References: [1] Hinrichs J. L. and Lucy P. G. (2002) *Icarus, 155,* 169-180. [2] Lyon R. J. P. (1964) NASA Conf. Rept. CR-100. [3] Donaldson Hanna K. L. et al. (2012) *J. Geophys. Res., 119,* 1516-1545. [4] Helbert J. F. et al. (2013) *EPSL, 371-372,* 252-257. [5] Byrne S. A. et al. (2015) *LPS XLVI,* Abstract #1499. [6] Dyar M. D. (2016) *SSERVI Expl. Sci. Forum*, nesf2016-043.