

## VALUE OF SAMPLE RETURN AND HIGH PRECISION ANALYSES: NEED FOR A RESOURCE OF COMPELLING STORIES, METAPHORS AND EXAMPLES FOR PUBLIC SPEAKERS. J. H. Allton<sup>1</sup>,

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**Introduction:** *“Sample return has unique advantages. There are no limits to the quality or number of analyses, no limits to the flexibility and scope of investigations, and no limits on future use as new techniques are developed and new theories are proposed.”* [1]. There is widespread agreement among planetary scientists that much of what we know about the workings of the solar system comes from accurate, high precision measurements on returned samples [2-6]. Precision is a function of the number of atoms the instrumentation is able to count. Accuracy depends on the calibration or standardization technique. For Genesis, the solar wind sample return mission, acquiring enough atoms to ensure precise SW measurements and then accurately quantifying those measurements were steps known to be non-trivial pre-flight. The difficulty of precise and accurate measurements on returned samples, and why they cannot be made remotely, is not communicated well to the public. In part, this is because “high precision” is abstract and error bars are not very exciting topics. This paper explores ideas for collecting and compiling compelling metaphors and colorful examples as a resource for planetary science public speakers.

**Metaphors and Stories:** Verbal metaphors and similies can be vivid and most easily used in speaking. Sportscasters have honed these to a fine art, but planetary scientists have something to offer.

**A Graphic Metaphor:** Scott Sandford uses a comparison of apples and oranges using IR spectroscopy (as a simulation for remote data) compared to high pressure liquid chromatography laboratory data. Apples and oranges appear indistinguishable via IR spectroscopy, but HPLC laboratory measurement clearly shows distinctions in abundances of sucrose, glucose and fructose between an apple and an orange (Fig. 1) [7]. The resulting visual comparison strikingly leaves the impression that not all analyses are equal.

**Characteristics of a Memorable Metaphor:** Apples vs. oranges, like a good story, touches the listener by way of a topic the listener understands or cares about. Imagery encompassing vision, smell and taste is a part of a good connection implied in this example using fruit (hearing and touch are candidates to consider for other metaphors).

**Stories in Support of Sample Return Rationale:** Mike Zolensky powerfully illustrates dimension and complexity in a cross-section drawing of a 10-

micrometer grain subdivided for a number of analyses and associated science return (Fig. 2) [8]. The figure shows what can be done with a particle the size of copier toner! Several simplified metaphors for public communication could be drawn from this figure, and one is the large suite of instrumentation applied to measure tiny differences, instruments which cannot be flown in space. For example, many tiny asteroid particles are analyzed on the SPring-8 synchrotron, the world’s most powerful synchrotron radiation source, larger than many shopping centers (Fig. 3).

Stories, metaphors and examples of the results from planetary samples have been used by effective planetary science authors and speakers. Planetary Science Research Discoveries consistently produces compelling stories of science results. The travels of the chondrule in Stardust grain “Iris” is a good story [9, 10].

**Communicate Dimension, Complexity and Resolving Power:** Stories in support of sample return rationale or science success, while interesting and compelling, often do not detail the complexity of calibration or sample handling. The required sensitivity and resolving power may not be placed in perspective. The difficulty of precise and accurate measurements on returned samples, and why they cannot be made remotely, could be better communicated to the public by use of appropriate metaphors.

**Approach to furnishing a resource for speakers:** This paper contends that there is: (1) a need for explaining high precision analyses and that (2) a feasibility assessment should be attempted as outreach. Issues to address could include, determining what speakers want (subject, format), how to collect and compile useful material, issues of copyright, mechanics of making content available. As a first step, a survey could be conducted at LPSC to determine if there is a need for any resource in addition to what is already provided. Initial thoughts were an informal “book of quotations” shared among colleagues. Response from a few colleagues was much more inclusive, and so further survey is appropriate.

**References:** [1] Jones J. H. and Treiman A. H. [2] Messenger S. *et al.* (2009) White paper submitted to NRC Planetary Decadal Survey (asteroids and comets). [3] Treiman A. H. *et al.* (2009) White paper submitted to NRC Planetary Decadal Survey (Moon). [4] Treiman A. H. *et al.* (2009) White paper submitted to NRC Planetary Decadal Survey (Mars). [5] Davis A.

M. *et al.* (2009) White paper submitted to NRC Planetary Decadal Survey (analytical capabilities). [6] Shearer, C. K. and Borg L. E. (2006) *Chemie der Erde* 66, 163-185. [7] Sandford (1995) *Annals of Improbable Research*, 1. [8] Zolensky M. E. *et al.* (2000) *Met. Planet. Sci.* 35, 9-29. [9] Ogliore, R. C. *et al.* (2012) *Astrophys. J. Letters*, 745: L19-L23. [10] <http://www.psrh.hawaii.edu/Feb12/chondrule-Wild2.html>.

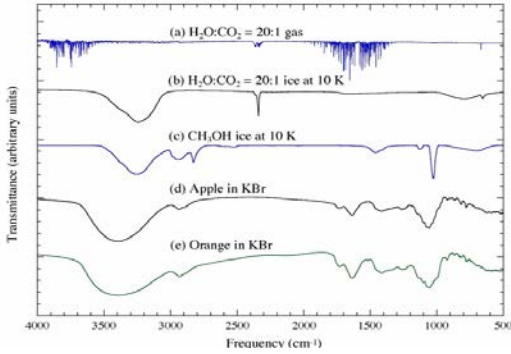
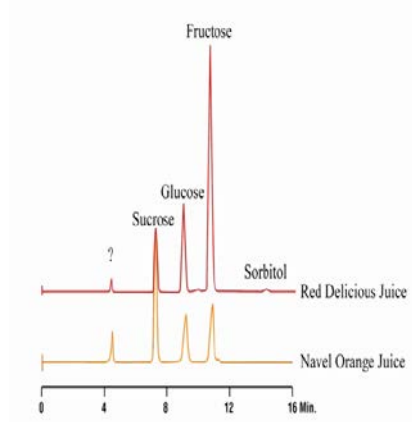


Fig. 1a and 1b. Simulating remote observations (IR spectroscopy) vs laboratory measurement (from Sandford [7]).



Chady & Young (1999) Carbohydrate profiles of orange juice and apple juice by HPLC and evaporative light scattering detection.

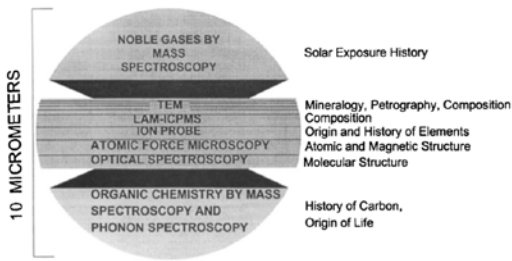


FIG. 1. A schematic showing the incredible amount of information that can be gained from careful dissection (by ultramicrotome) and consortium study of a single grain measuring 10 μm. Not all applicable techniques are even shown.

Fig. 2. Dimension and complexity achievable in analysis of small particles, from Zolensky *et al.*[8].



Fig. 3 SPring-8 synchrotron, Japan.