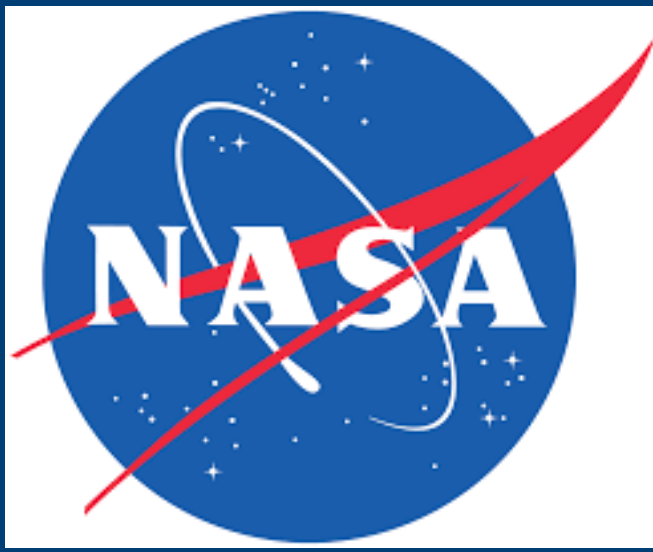


# Evidence for a polysulfane species in CM chondrites

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## Introduction

Sulfur is an abundant and highly reactive element in the Solar System and it is involved in all stages of planetary/parent body formation and evolution. Isotopic analyses of extraterrestrial materials have the potential to provide a diagnostic tool to characterize the processes that have occurred early in our solar system and profoundly shaped the world around us in the distant past, and continue to have an impact today. The nature and origin of isotopic heterogeneity of sulfur in primitive asteroids is still somewhat unknown and warrants further research.



Artist rendition demonstrating the events responsible for paired meteorites.

My samples were from the ALH 83100 pairing group (Allan Hills, Antarctica).

<https://curator.jsc.nasa.gov/antmet/samples/peldes.cfm?sample=ALH83100>



$$\delta = \left( \frac{R_x - R_{std}}{R_{std}} \right) \times 1000$$

$$\Delta_{A-B} = \delta_A - \delta_B$$

Notation used to demonstrate the values obtained from the mass spectrometer.

$$\Delta^{33}\text{S} = \delta^{33}\text{S} - 1000 * ((1 + \delta^{34}\text{S} / 1000)^{0.515} - 1)$$

Table depicting the heterogeneity displayed in Murchison by Gao & Thiemens (1993) and Labidi et al. (2017).

Reference	$\Delta^{33}\text{S}$ (Sulfates)	$\Delta^{33}\text{S}$ (Sulfide)
Gao & Thiemens 1993	0.029	0.040
Gao & Thiemens 1993	0.029	0.003
Labidi et al., 2017	0.263	0.156

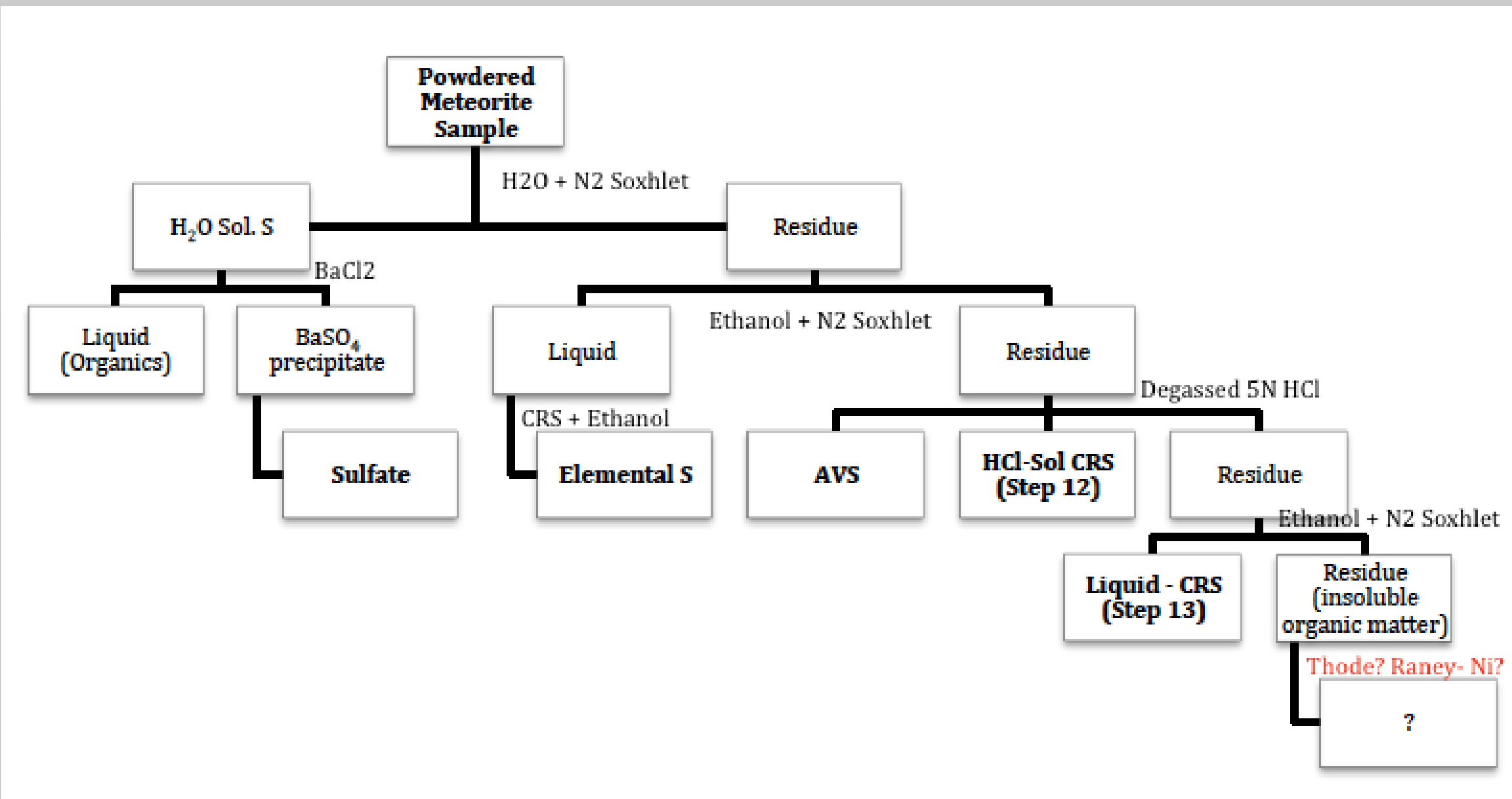
## Hypotheses

1.) Measurements of the  $\Delta^{33}\text{S}$  value for paired meteorite samples will show the same compositional variability that is seen in Murchison.

2.) One of the sulfur compounds analyzed from the ALH 83100 related meteorite pairs is derived from an organic polysulfane species that was decomposed by the acidification procedure.

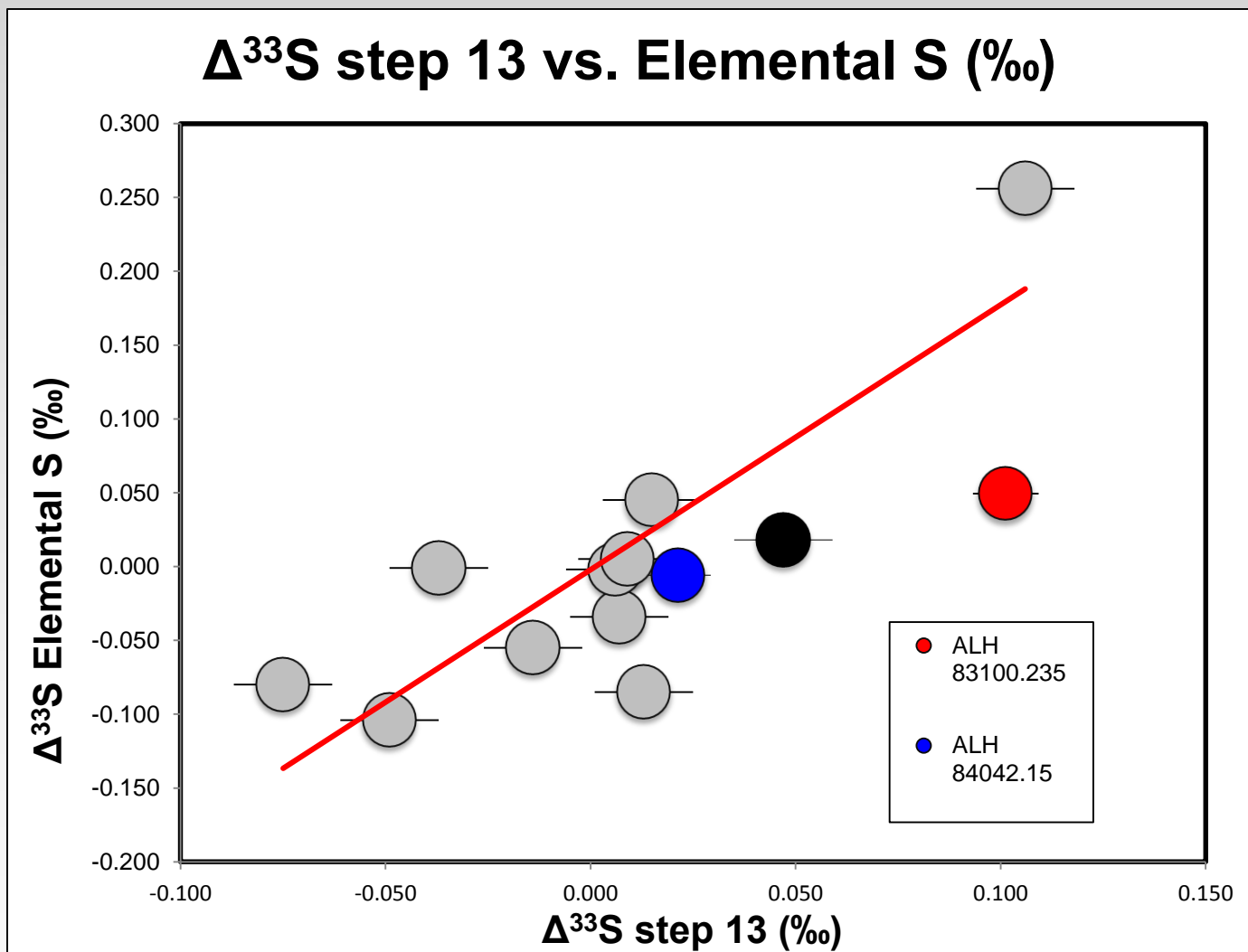
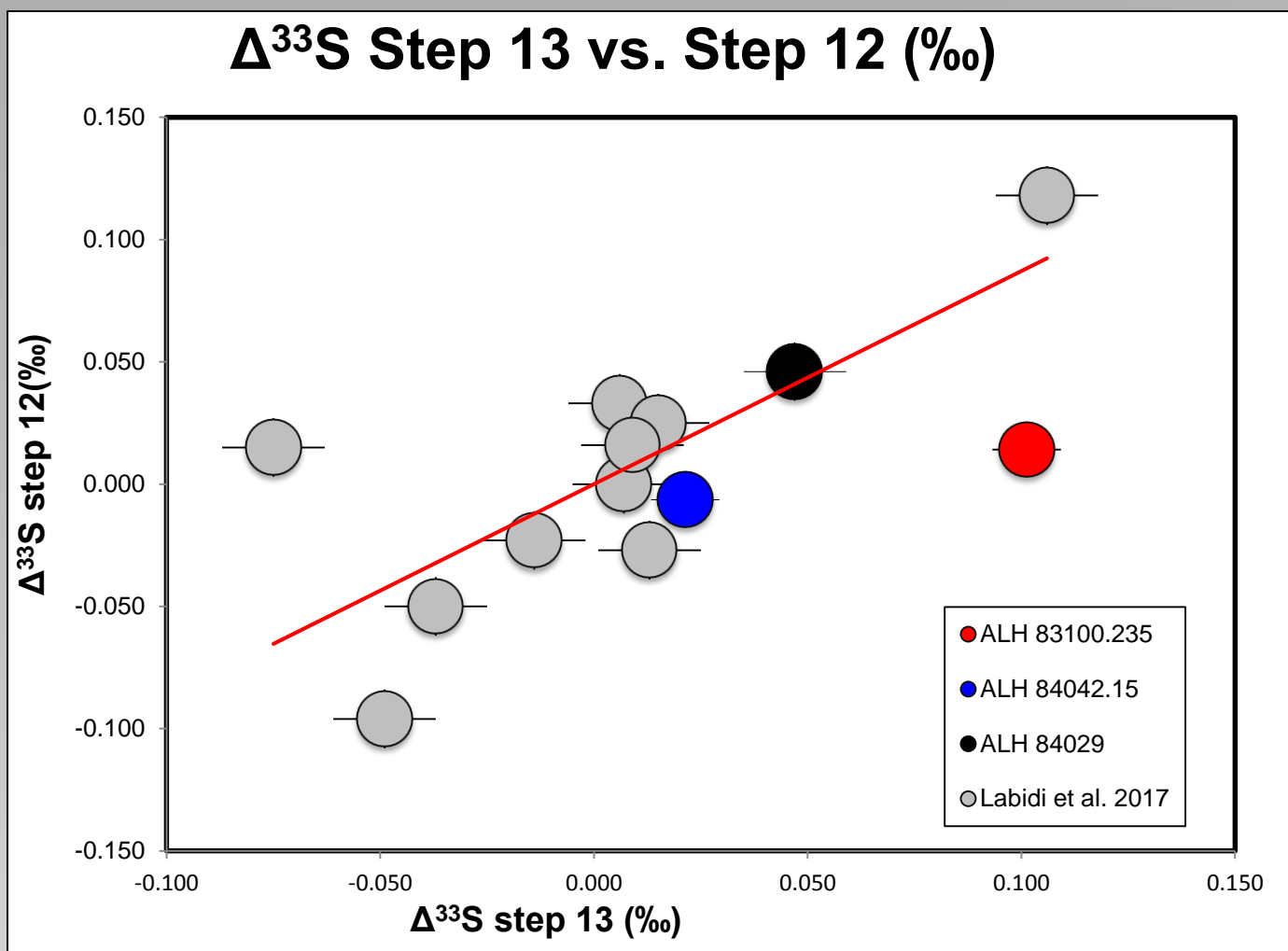
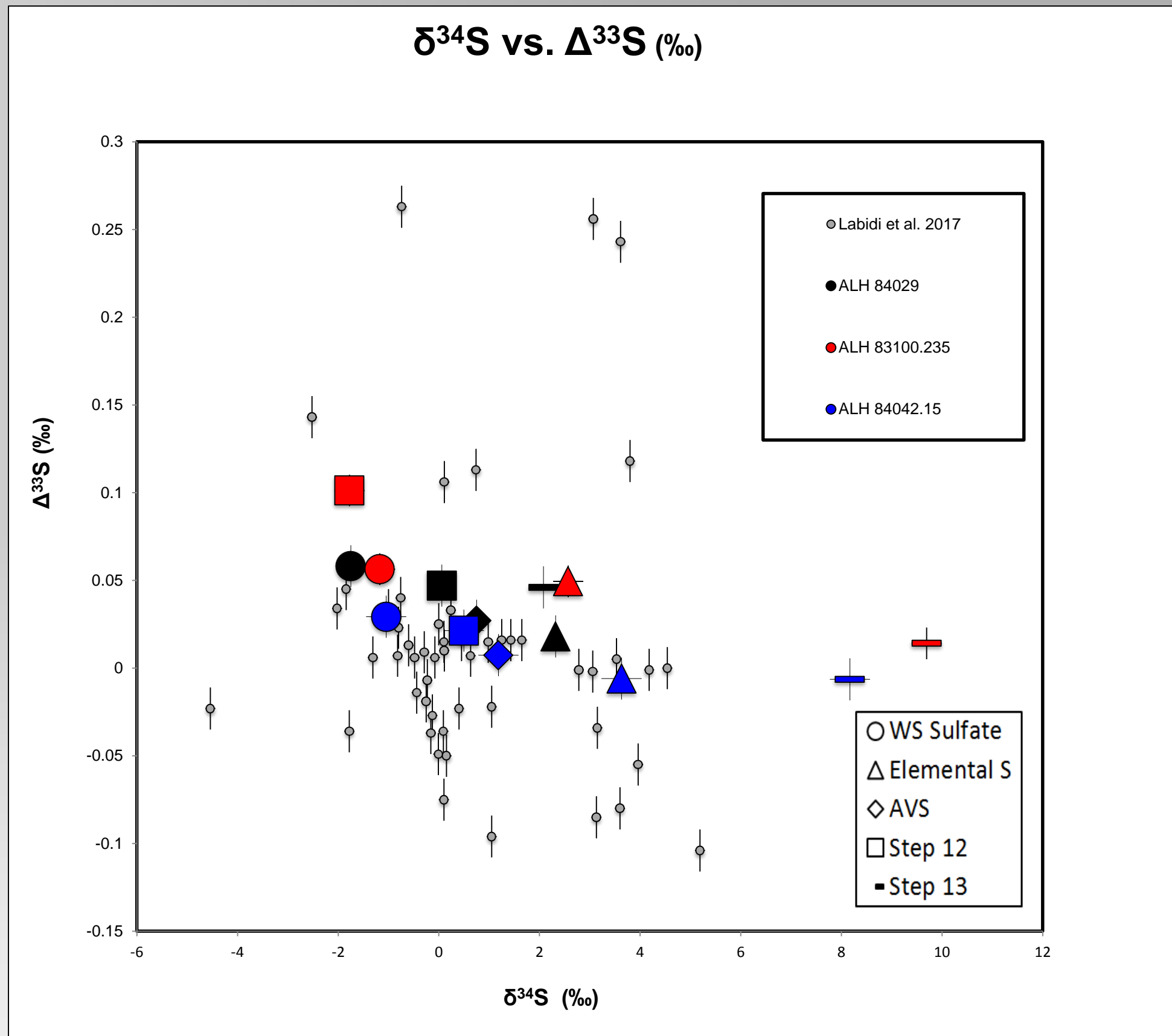
## Methods

### Sequential Extraction Procedure



All extraction products are then analyzed in the ThermoFinnigan MAT 253 gas source IRMS (isotope ratio mass spectrometer).

## Results



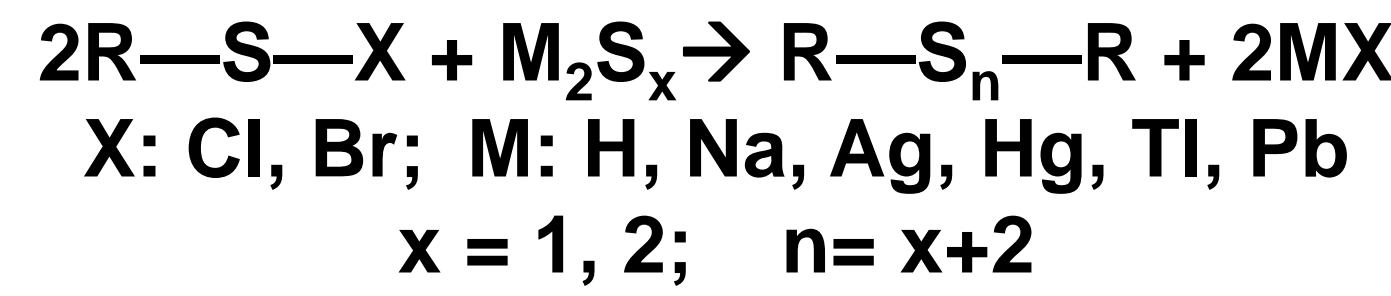
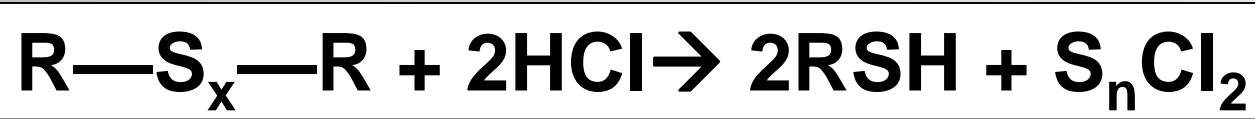
### Heterogeneity of Sulfur Among Paired Meteorites

### Evidence for a Polysulfane Species

Evidence for the presence of a new compound is revealed by differences for the  $\Delta^{33}\text{S}$  values of both 2<sup>nd</sup> Elemental S extracted.

From the extraction procedure: the new species must have only become available after the sample was reacted with hot 5N HCl.

From a literature search: I propose that the unknown component that was traced in the ALH 83100.235 sample is an organic polysulfane compound with a structure of R-S<sub>x</sub>-R.



Possible reactions that could alter the polysulfane

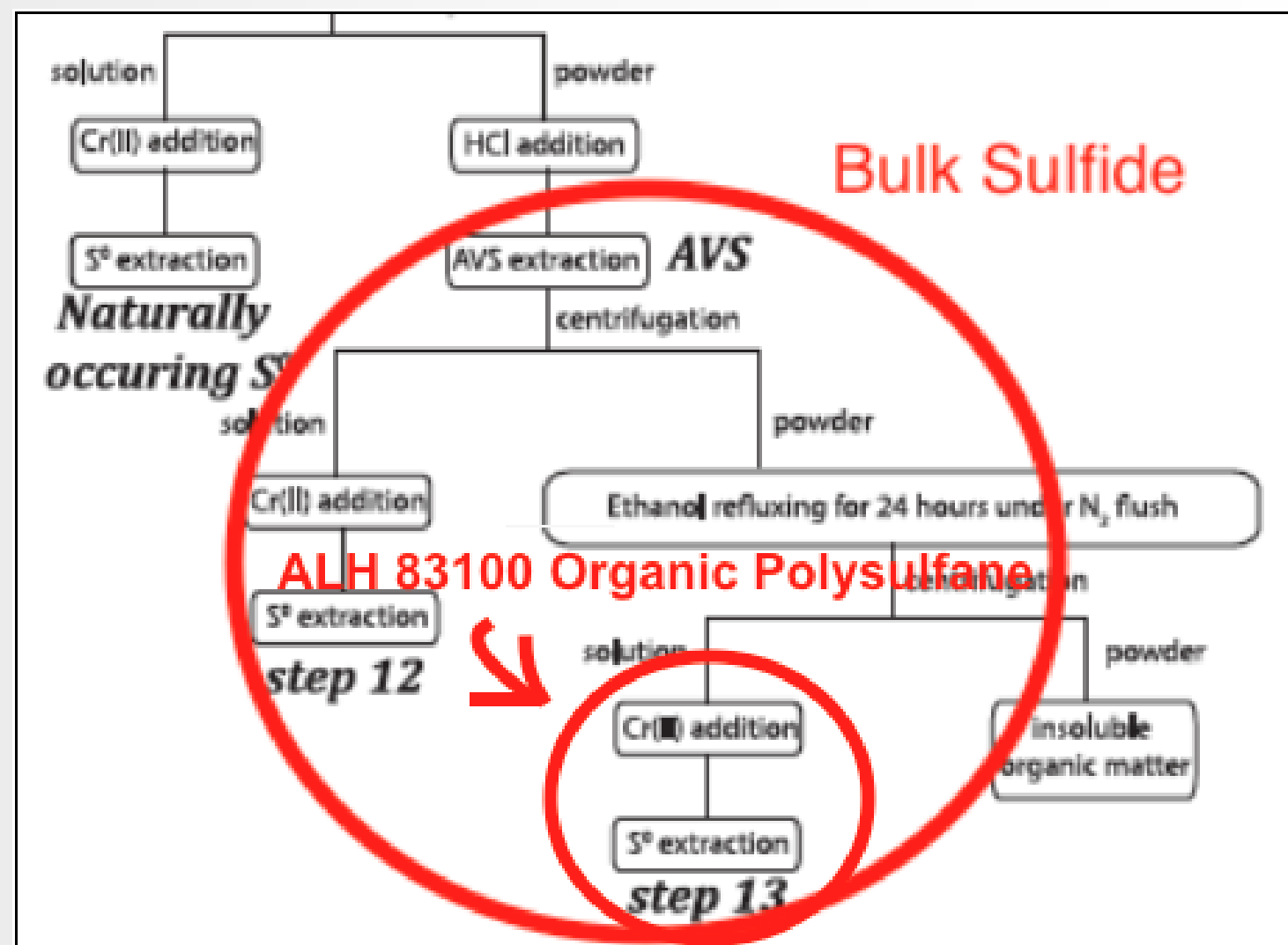
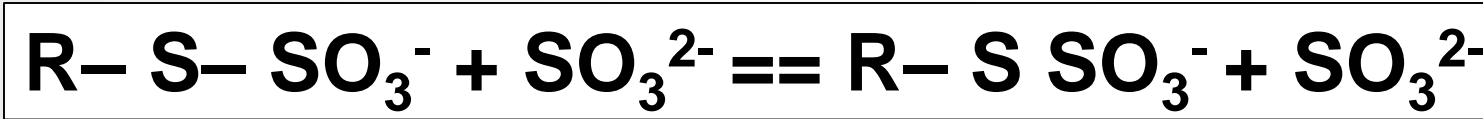


Image depicting the Kleinmann-Lowe region of the Orion Nebula. Is there polysulfane in these environments?

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