Figure 2. from

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Goals	Science Objectives	Science Measurement Requirements	Instrument Requirements	Mission Requirements
Did nearby supernova trigger molecular cloud's collapse into pre-solar disk? - DS PQs Q1, Q2, Q3	**O1:** Determine whether early compositional reservoirs of short-lived radionuclides in the protoplanetary disk were (1) homogenous or (2) heterogenous between the inner solar system CAI and Chondrule forming regions and the outer solar system comet's formation region.	**1.1** 26Mg/24Mg, 26Mg/25Mg, 27Al/24Mg, 26Al/27Al (2σ <8 ppm) for age and abundance	SIMS	**Sample Handling Requirements:** Total Sample Mass: ≥ 29 g Sampling depth: >100 nm Curation sample temp: <25°C (long-term storage @ -80°C) **SRC Requirements:** Hermetic seal; Temperature control at <25°C; Separate volatiles containment
		1.2 52Cr/50Cr, 53Cr/52Cr, 54Cr/52Cr, 55Mn/52Cr, 53Mn/55Mn for age comparison to Al-Mg and to date alteration (2σ<14 ppm, <1 My)		
		1.3 206Pb/204Pb, 207Pb/206Pb, 207Pb/235U, 206Pb/238U (2σ <1 ppb) for absolute age (2σ <1 My)	MC-ICP-MS	
What role did comets play in the delivery of volatiles to Earth's atmosphere and interior? - DS PQs Q3, Q10	**O2:** Determine whether volatiles were predominantly delivered to Earth via an early bombardment of 67P-like comets.	**2.1** Abundance of stable isotopes of H (for δD ±10‰) in H2O	GC-MS/IRMS	
		2.2 Abundance of stable isotopes of N (for δN ±10‰) in NH3 and N2		
		2.3 136Xe/132Xe and 128Xe/132Xe < ± 0.02	Noble Gas Mass Spec	
		2.4 82Kr/84Kr and 86Kr/84Kr to < ± 0.02		
		2.5 36Ar/38Ar to < ± 0.03		
Did comets deliver biologically-relevant organics to Earth, and if so, what were the origins of these cometary molecules? - DS PQs Q9, Q10	**O3:** Determine whether comet 67P is host to biologically relevant molecules and if so, whether they formed in presolar interstellar environments, the protoplanetary disk, or as a consequence of parent-body processes.	**3.1.** Amino acids (<10 ppm), hydroxy acids (<10 ppm), N-heterocycles (<10 ppb), sugar/derivatives (<10 ppb), fatty acids (<10 ppm)	LC-MS , GC-MS	
		3.2. Compound-specific isotope ratios in IOM and biologically-relevant SOM. IOM: δD: ±100 ‰, δN: ±100 ‰, δC: ±50 ‰, δO: ±20 ‰ SOM: δD: ±10 ‰, δN: ±2 ‰, δC: ±1 ‰	IOM: NanoSIMS SOM: LC-HRMS, GC-IRMS	
		3.3. Coordinated analysis of organic molecules (res. < 100 nm) with a Pearson correlation to statistically relate the association of organic molecules with presolar grains, ices, volatiles, metals, and minerals	XRF, SEM-EDS, Raman, Nano-SIMS, L2Ms	
		3.4. Enantiomeric excess: |%D - %L| for amino acids, hydroxy acids, and sugars/derivatives (0-100% ee)	LC-HRMS	

Reconnaissance Requirements	Instrument Requirements	Mission Requirements
R1. Near-global (>90%) surface morphology via images (to <0.5 m scales) for sample site selection to avoid obstacles and target recently exposed material	Color Camera: GSD: <0.25 m SNR >20	HAMO @ 25 km LAMO @ 7 km Polar orbit Pointing Stability: <20 arcsec/sec Nadir Pointing
R2. Near-global (>90%) distribution of exposed minerals with ≤±10% abundance precision per (<=100 m)*2 to select sample site with: (O1) the mineral plagioclase for chronology, (O2) H2O and CO2 ice for volatiles work, and (O3) C-H bonds in organics	Hyperspectral Imager: Spectral Range: 0.8-4.5 μm Spectral Res.: <5 nm GSD: <33 m SNR >180	