Report on the chemical composition and physicochemical characteristics of giant hail fallen in the year 2025 in Funes, Santa Fe Prov., Argentina.

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Introduction:

The formation of giant hailstones is an uncommon meteorological phenomenon that has devastating consequences in inhabited areas. This hazard has occurred with greater frequency and size in recent years, making it necessary to better understand it. The generally accepted mechanism is that the large size occurs through a process similar to the formation of smaller hail, but with exceptional duration and more intense updrafts . Recent evidence suggests that biotic factors (bacteria) and abiotic factors (ions, fibers, energies, geoengineering) influence the growth of these unusually large chunks of ice (Kozjek, 2023).

Our climate system is spinning out of control. While there are countless causal factors and countless forms of anthropogenic damage to the climate system, many paths in this equation lead directly to ongoing global climate modification programs. Chemical artificial ice nucleation is constantly used in covert weather modification programs (Wigington, 2014; Geaves, 2025). The use of these materials cools the clouds and, consequently, the air mass beneath them. But what happens when these artificial elements cause ice formation at temperatures far higher than usual, in much greater concentrations, and much earlier than would have occurred during the development of a storm?

Global climate modification is an uncontrolled and deranged machine. Currently, truly natural weather does not exist. Everything is contaminated by the rampant geoengineering onslaught that has been unleashed upon planet Earth. Climate engineers will continue to create increasingly extreme conditions (Wigington, 2015). Much more frequent hailstorms and exceptionally large hailstones are forecast. Antarctica has filled with ice, yet they tell us it is part of “warming”; they go out of their way to present every "unexpected phenomenon" under the label of climate change and with explanations that make no sense (Perfil, 2026).

Over recent decades, there has been an 84% increase in damage caused by hailstorms, and this rise continues to grow. Other recent examples exist of unprecedented "ice balls" created through the massive artificial/chemical spraying of nucleating elements (Geoen, 2015).

The particles can be drawn into convective cloud updrafts, acting as cloud condensation nuclei (CCN) or ice nucleating particles (INP), which are essential for hail formation . Particle size and chemical composition influence nucleation efficiency and the rate of growth within hailstones (Fajardo et al., 2016). Previous studies have investigated the composition and properties of hail using various techniques to determine its chemical components. For example, Šantl-Temkiv et al. (2013) analyzed hailstones from a thunderstorm in Slovenia, determining the dissolved organic carbon and total dissolved nitrogen in hailstones. More recently, Kozjek et al. (2023) expanded hail analysis in Slovenia by identifying fibrous and abiotic particles in melted hailstones. On the other hand, Santoyo et al. (2002), Samiha et al. (2018), and Li et al. (2018) examined the constituents in melted hailstones in Spain, Bangladesh, and China, respectively. In their studies, the concentrations of different ions were compared.

The concentration of water-soluble ions, metals, and metalloids in hailstones was investigated for the first time in South America by Beal et al. (2021), who analyzed hail samples from the Triple Frontier of Paraná, Brazil, and Argentina using ion chromatography and inductively coupled plasma mass spectrometry. They found that nitrate, sulfate, and potassium were the most abundant ions in their samples and interpreted that this was related to agricultural activities in non-local regions via long-distance transport. However, it cannot be ignored that climate management can also exert a strong influence .

For years, atmospheric chemical seeding has been carried out, whether to attempt to modify the natural conditions of a specific storm or to manage climatic factors on a permanent basis; metallic particles and various chemical compounds are systematically dispersed in the skies of Argentina. Documentation exists on one of the world's most important sites investigating geoengineering projects globally, which includes Mendoza and Argentina in its global map of weather modification operations since the late 1950s (Geoengineering Monitor, 2026) **.** Artificial intervention and climate engineering, unfortunately being carried out at multiple levels in our country **,** is neither harmless nor ethical from any point of view, no matter how much those who promote and defend it seek to downplay its real risks and effects (Sustersic, 2024).

Cloud seeding with artificial nuclei should tend to increase the amount of small ice particles competing for the available supercooled droplets (Schüler 2024). Nucleating elements have already been detected in numerous laboratory tests of snow, such as: aluminum, barium, chloride, and copper (Geoen, 2015). Therefore, seeding should result in a reduction of the average size of the hailstones. It is also possible that if a snowstorm is overseeded with an extremely large quantity of ice nuclei, most of the supercooled droplets in the cloud will nucleate; therefore, this would lead to the growth of giant hailstones (Hobbs, 2000).

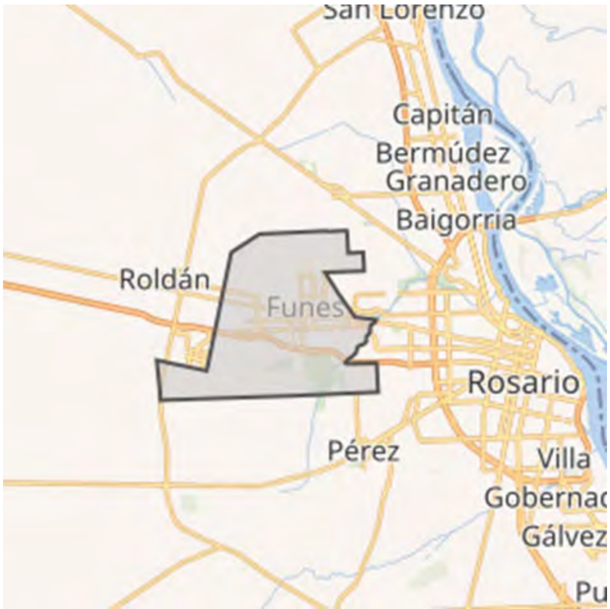
In April 2025, in the city of Funes, Santa Fe Province, Argentina, the population was caught off guard by a giant hail storm that did not melt despite the 27 ° C recorded a few hours later. Following the residents' interest in determining the origin of these giant hailstones, studies were requested from three private laboratories: Greenlab (Rosario), JLA (Córdoba), and Patagonia Instrumental (Rosario), which were funded by donations from many citizens across the country. This report presents the analyses of the hail samples to identify their physicochemical characteristics, as well as the presence of microparticles and inorganic elements, to contribute to the understanding of the composition of the giant hailstones that fell in the city of Funes.

2. Materials and methods

2.1 Samples:

The samples were received from the sampling zones (Figure 1) by the various laboratories following rigorous cleaning and sterilization protocols to prevent contamination . The hail samples were thawed and prepared for the various analyses. Beakers were used for the initial handling of the liquid samples.

To ensure sample purity and avoid cross-contamination, the entire process was carried out in a sterilization chamber with 95% cleanliness, using UVC at 135 nm, ozone saturation, and a controlled temperature of 30°C ± 0.1°C.



SAMPLES	SAMPLING:
M1 - La Siesta Street	Nahuel Montaña
M2- Echeverría Street	Pablo Serrano
M3 - Vieytes Street	Jesús Ciavatti

Figure **1**: Map of the locality of Funes, Santa Fe, Argentina and hail samplings.

2.2 pH Determination:

The pH of the samples was measured using a pH meter with temperature control at 25°C and an accuracy of 0.1%. To verify the results, two types of test strips were used.

2.3 Determination of Boiling Point:

The boiling point was determined by preparing a digital hot plate. The sample was placed in a test tube, which was inserted into a 250 ml beaker. This beaker, acting as a thermal bath, was heated directly on the plate, thus guaranteeing accuracy and preventing sharp temperature variations during the measurement process (Figure 2). The sample temperature was measured with a precision immersion thermometer, coupled using thermal paste to ensure proper heat transfer. The measurement was performed at an atmospheric pressure of 1015.3 hPa. The reading was confirmed with a digital thermometer.

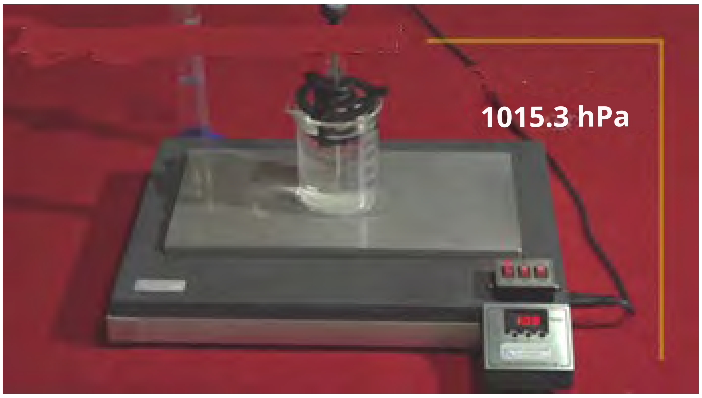


Figure **2:** Digital hot plate with precision immersion thermometer for boiling point determination

2.4 Freezing Point Determination:

To determine the freezing point, the sample was placed in a 60 mm borosilicate Petri dish. The dish containing the sample was placed into a programmable cold chamber (Figure 3). The freezing point was recorded at an atmospheric pressure of 1011 hPa.

Figure **3:** Programmable cold chamber for freezing point determination.

2.5 Microscopic Observation and Calibration:

Samples were prepared on glass slides using precision micropipettes for aliquot sampling. Coverslips were used for wet mount preparations. Other samples were dried in a controlled dehydration chamber at 30°C for 6 hours in a clean area (Figure 4).

Figure **4:** Microscope slide with dehydrated sample for microscopic analysis

Observations were performed using an optical microscope with objectives of different magnifications (Figure 5). Observations were carried out using both white light and UV light in a range of 360 to 385 nm. For image calibration and size determination, a 10 μm gold wire was used to calibrate the microscope's field of view. This calibration allowed the generation of a grid with green lines superimposed on the images, from which the size of the observed elements could be calculated. Each grid division represented 10 μm, and a total quadrant of 81 μm, all at a magnification of 400x.

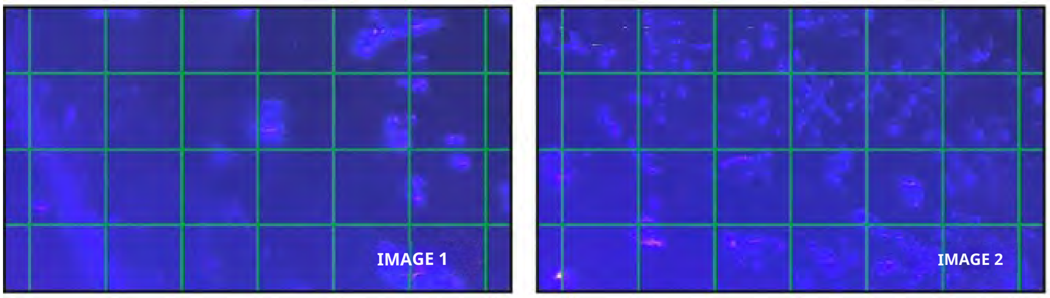


Figure **5:** Grid for particle size measurement with UV light.

2.7 Detection of chemical elements by ICP-MS (Mass Spectrometry) and ICP-OES (Optical Emission Spectrometry).

With these methodologies, nearly 95% of the periodic table can be analyzed. The main advantage over other methodologies is its high sensitivity (low detection limits) and simultaneity (several elements detected in the same analysis). Most chemical elements of the periodic table can be determined, with the exception of some with low atomic mass and those with an atomic mass greater than uranium. In this work, the analysis of sulfur, fluorine, and chlorine was detected at GREENLAB Laboratory as sulfur sulfate, fluorides, and chlorides using standardized methods for the examination of water and wastewater APHA-AWWA-WEF (USA).

The main differences between ICP-MS (Mass Spectrometry) and ICP-OES (Optical Emission Spectrometry) lie in sensitivity, detection limit, and measurement technique. ICP-MS is superior for ultra-traces (parts per billion/trillion, ppt) and isotopic analysis, while ICP-OES is better for high concentrations (ppm) and samples with a complex matrix. ICP-MS was performed at the JLA laboratory (Córdoba, Argentina) and ICP-OES was performed at the GREENLAB laboratory (Rosario, Argentina) (Figure 6). Samples analyzed by ICP-MS were concentrated 50-fold prior to measurement .

A

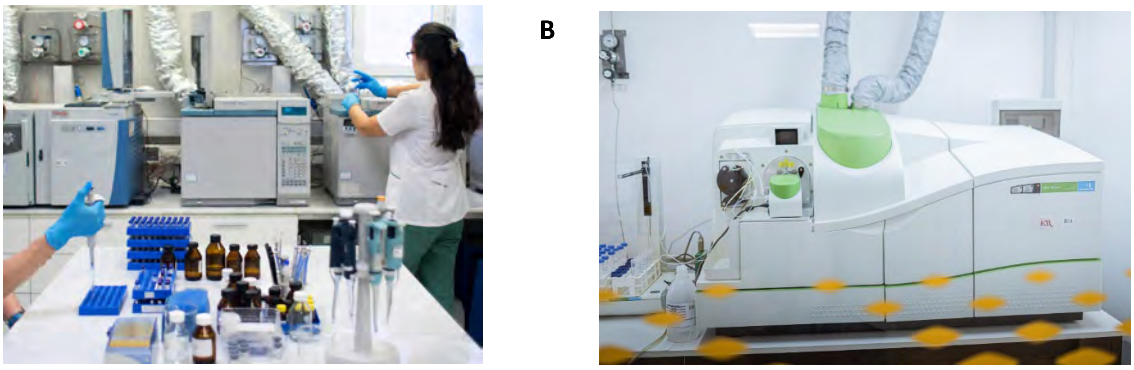


Figure **6:** GREENLAB laboratory ICP-OES equipment (A), JLA ICP-MS equipment (B)

Samples were kept refrigerated between 8 and 11 °C from the time of receipt until the day of digestion. They were vortex-mixed to ensure homogeneity prior to sampling. The studies were conducted by the technical staff in charge of the equipment.

3. Results and discussion 3.1 General

Characteristics of the Hail:

The hail presented an apparently normal visual appearance without noticeable impurities to the naked eye. Its shade was opaque white, with signs of microbubbles. The average size of the fragments ranged between approximately 1.2 to 1.7 cm, with a smooth, spherical shape and no notable protrusions. The homogeneous surface arrangement may have indicated uniform direction and intensity.

3.2. Physicochemical Properties:

The average pH of the samples was 6.6 at 25°C, which is slightly acidic and consistent with the dissolution of atmospheric gases such as carbon dioxide. The pH of "natural " rainwater has an expected value of 5.7 due to the presence of carbonic acid in the atmosphere: carbon dioxide and water (Singh & Agrawal, 2008). The deviation of the hail water's pH to values higher than rainwater would likely indicate a shift in the acid-base equilibrium of atmospheric chemistry, indicating the presence of hydroxide ions in the solution (Carnicom, 2015a).

The boiling point was determined to be 101.5°C at 1015.3 hPa, a value slightly higher than that of pure water at standard pressure, which could be attributed to the presence of dissolved solids. In highly contaminated rainwater, 102.5°C has been detected as the boiling point in the USA (Carnicom, 2016). The freezing point was -0.9°C at 1011 hPa, indicating a freezing-point depression consistent with the presence of solutes in the hail matrix.

3.3. Microscopic Analysis of Microparticles:

Microscopic observations revealed the presence of various microparticles (Figure 7) . Samples A and B, initially characterized by containing particles under brightfield, also showed fluorescent components under UV light (C and D confirmed this fibrous morphology and their fluorescence in detailed observations). The dimensions of these synthetic fibers were estimated at 0.5 µm in diameter and between 12 and 20 µm in length, classifying them as microplastics.

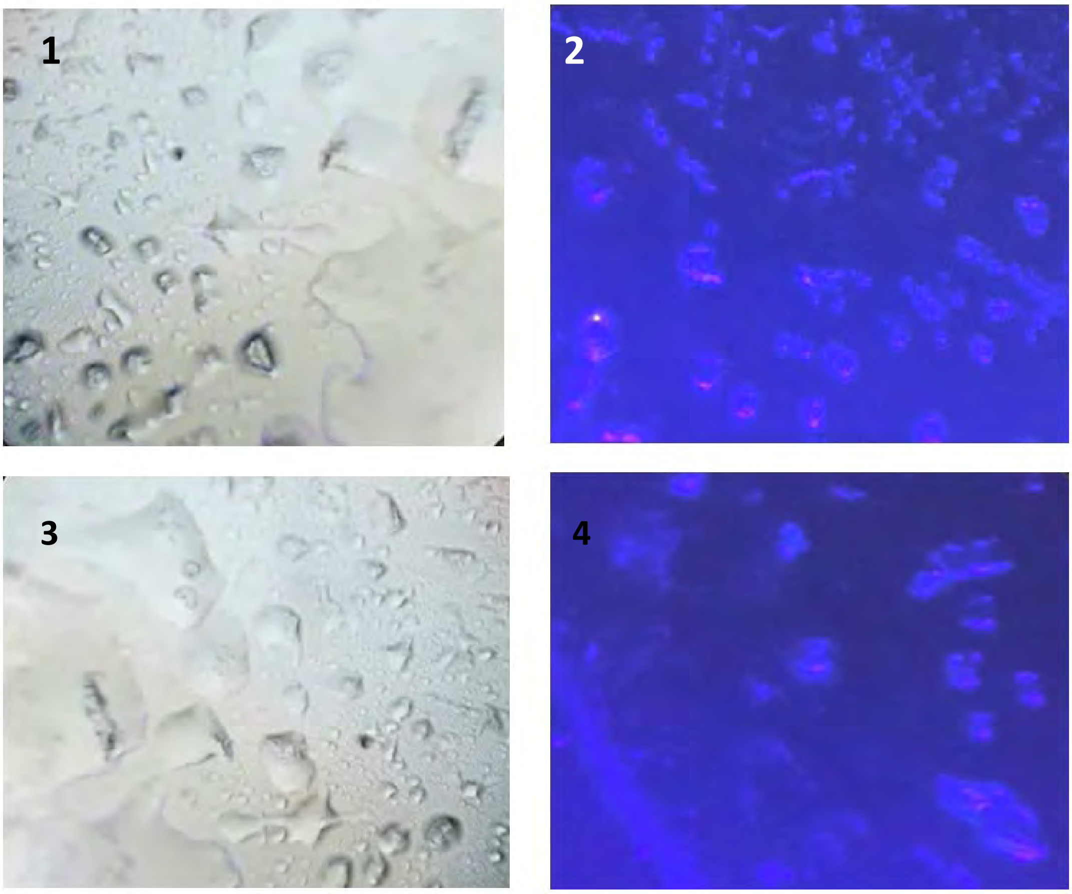


Figure **8** : Microscopic observation of particles at 400x in brightfield (1 and 3) and under fluorescent light at 380-365 nm (2 and 4).

These polymeric fibers exhibit absorption spectra (peaks at 300 nm and 330 nm) and emission spectra (peaks between 360 nm and 380 nm), indicating that they could correspond to plastic polymers (polyester), as observed in previous studies (Pelúas et al., 2018). This reinforces the hypothesis of the presence of microplastics of a polymeric nature in the hail, which fluoresce under the 360 nm and 380 nm excitation wavelengths used in this study.

To confirm the polymeric nature and characterize these structures, techniques such as Raman spectroscopy, Fourier-transform infrared spectroscopy (FTIR), transmission electron microscopy (TEM) or scanning electron microscopy (SEM) could be employed to obtain morphological details at higher resolution, and size-exclusion chromatography (SEC) to determine the molecular weight distribution of the polymers.

3.5. Detection and quantification of chemical elements:

To determine the elemental composition quantitatively in the hail samples (Table 1), analyses were initially performed using ICP-OES and APHA-AWWA-WEF techniques. Sulfur as sulfate, sodium, calcium, magnesium, silicon, and potassium were determined using ICP-OES, while chlorides, nitrates, and fluorides were determined using APHA-AWWA-WEF. These techniques have intermediate sensitivity, but they were used to conduct an initial screening of the samples. Upon observing that Sample 3 was more dilute than the other two in major components such as calcium, potassium, and sodium, this sample was discarded for further analyses due to budget constraints. In a second analysis, the quantification of additional chemical elements by ICP-MS was requested for Samples 1 and 2 (Table 1).

Table **1** Chemical composition of the analyzed hailstones.

Chemical species	**Concentration (mg/l)**			**Type of chemical element**
	M1.LA SIESTA	**M2.ECHEVE**	**M3.VIEYTES**	
ALUMINUM Al	0.166	0.197	ND	post-transition metal
ARSENIC As	0.003	nd	ND	metalloid
BARIUM Ba	0.008	0.002	ND	*alkaline earth metal*
BORO B	0.22	nd	ND	metalloid
CALCIUM Ca^{2+}	1.35	6.2	0.25	*alkaline earth metal*
CHROMIUM Cr	nd	0.012	ND	transition metal
STRONTIUM Sr	0.015	0.005	ND	*alkaline earth metal*
FLUORIDES F^-	ND	ND	0.12	halogen
GALLIUM Ga	0.002	nd	ND	post-transition metal
MAGNESIUM Mg^{2+}	0.180	2.09	ND	*alkaline earth metal*
NITRATE NO_3^-	3	2	ND	nonmetal
SILVER Ag	0.036	0.004	ND	transition metal
POTASSIUM K^+	1.81	1.81	0.38	*alkali metal*
SILICON Si	0.27	0.22	ND	metalloid
SODIUM Na^+	17.9	4.8	0.45	*alkali metal*
SULFATE SO_4^{2-}	3	4	ND	nonmetal
IODINE I	0.004	nd	ND	halogen
ZINC Zn	nd	0.038	ND	transition metal

***nd** not detected, **ND** not determined.* In bold heavy metals by definition (Witkowska et al., 2021).
In italics: reactive metals.

The percentage contribution order of each ionic species based on the average concentrations in the hail under study was as follows: Na^{+} > Ca^{2+} > SO_4^{2-} > NO_3^{-} > K^{+} > Mg^{2+} > Si^{+} > Al. The most abundant ions (Na^{+}, Ca^{2+} and SO_4^{2-}) contributed approximately 46%, 15%, and 14%, respectively, of the total quantified elements. The trend for metals, nonmetals, and metalloids (µg/L) was as follows: B (110) > Ag (21) > Zn (19) > Sr (10) > Cr (6) > Ba (5) > I (2) > As (1.5) > Ga (1). It is reported that Al, Na^{+1}, sulfates, nitrates, Ca^{+2}, and Si^{+} exhibit ice-nucleating activity when present in the form of oxides and salts (Pruppacher & Klett, 1997; Wex et al., 2014).

There are few studies reporting on the chemical composition of hailstones in different countries across the world (Li et al., 2018; Santoyo et al., 2002; Samiha et al., 2018; Beal et al., 2021), and it is difficult to compare the relative concentrations of each element since they are strongly influenced by the type of environment and anthropogenic activity (Table 2).

Table 2 Chemical composition of hailstones analyzed in various countries.

		Concentration (mg/l)				
Chemical species		**Spain**	China	Bangladesh	Brazil	Argentina
Aluminum	Al				0.016	0.18
Barium	Ba				0.002	0.01
Boro	B					0.11
Calcium	Ca^{2+}		0.45	0.08	0.014	**3.78**
Chromium	Cr				0.001	0.01
Strontium	Sr				0.003	0.01
Magnesium	Mg^{2+}		0.03	0.050	0.19	1.14
Nitrate	NO_3^{-}	**4**	**1.84**	**0.044**	**0.40**	**2.50**
Silver	Ag					0.02
Potassium	K^{+}		0.46	0.044	0.25	1.81
Silica	Si					0.25
Sodium	Na^{+}		0.73	0.060	0.07	**11.35**
Sulfate	SO_4^{2-}	**17**	**1.79**	**0.050**	**0.10**	**3.50**
Iodine	I					0.004
Zinc	Zn			0.01	0.02	0.02
Number of samples		4	15	4	33	2
Reference		Santoyo 2002	Li 2018	Samiha 2018	Beal 2021	This work

In studies from other countries around the world, sulfate and nitrate species are the most abundant (Table 2). However, in the samples analyzed in this study from Argentina, the most abundant elements are sodium and calcium, followed by potassium and magnesium, which exhibit high hygroscopicity (Kelly et al., 2007; Sullivan et al., 2009); thus, they could collectively influence the formation of CCN and INPs, forming ice nuclei in clouds (Tang et al., 2016).

If we compare the chemical composition of hail reported in the Triple Frontier (Beal et al., 2021), an area close to the city of Funes, where the analyzed samples originate, most of the detected elements are in high concentrations in the Argentine samples compared to those from Brazil. An increase in concentration is observed (in times) of sodium (x162), sulfates (x35), aluminum (x11), potassium (x7), chromium (x7), magnesium (x7), nitrates (x6), and strontium (x3). Another noteworthy datum is that silver and iodine, two agents reported to generate hail in patents worldwide (Schaefer, 1948), were detected exclusively in the hail samples from Argentina. This unique feature possessed by the hail in Argentina could indicate that these ions have been deliberately added to trigger these giant hailstones.

Weather modification activities are carried out by dispersing particles of different seeding agents into the air to produce cloud condensation or ice nuclei that give rise to hail. Silver iodide (AgI) is the preferred agent for these purposes because it has a crystalline structure similar to that of ice, which can induce the freezing of supercooled water (Schaefer, 1948, Ćurić and Janc, 2013). The amount of silver found in our hail water analyses is close to that permitted by international guidelines (NHMRC/NRMMC, 2004) that established a concentration of 0.1 mg/L of Silver Iodide as the threshold value for this compound (Fajardo et al, 2016).

On the other hand, if we compare the composition of rainfall in nearby areas of Brazil (López 2017), we see that our hailstones possess a very high concentration of calcium (x419), sulfates (x875), and potassium (x905). These large differences in the Funes hail samples show a different composition from that generally described for hail and rain in this geographic region, which could be a consequence of specific climate intervention by geoengineering.

For comparison purposes, several studies analyzed the composition of rain in areas with low and high human contamination. In rainwater from areas with very low human contamination, approximately 1 mg/liter is reported for all dissolved ions, and the contribution of reactive metal compounds represents a small fraction of that total (López et al, 2017). In contrast, highly contaminated rain contains up to 4 mg/liter of dissolved ions, with approximately 25% reactive metals (Hobbs et al., 2000). The hail samples analyzed in this study from Argentina total at least 26 mg/L of total salts, since quantification was not exhaustive, indicating an area with high contamination or evident climate manipulation, with approximately 53% reactive metals. In the cited cases of clean and contaminated rainwater, the contribution of reactive metal ions is quite small relative to the total (2-7%), and SO_4^{2-}, NO_3^-, and Cl^{-1} ions are the largest contributors to the contaminants (8 5-87%) (Carmicon, 2005). In contrast, in our hail samples only 24% correspond to anthropomorphic contaminants and 53% of the reactive metals, which could act as ice nucleating agents (INAs), could originate from climate intervention.

On the other hand, in a study of particulate matter taken from rain samples (post-intervention in the sky by planes emitting chemtrails) from the locality of Merlo (San Luis, Argentina), the presence of aluminum, arsenic, barium, boron, copper, chromium, strontium, gallium, magnesium, silver, silicon, and zinc was detected (Bayona, 2025), elements that were also detected in our hail samples from the city of Funes.

Research conducted over many years by the Carnicom Institute demonstrates unexpected levels of aluminum, calcium, magnesium, strontium, potassium, sodium, and barium in snow and hail (Carnicom, 2015b). A common denominator among all these elements is the ease of ionization that characterizes the elements of Groups I and II of the periodic table. Furthermore, it is recognized that one or more elements, such as aluminum, sodium, sulfur, nitrogen, calcium, and silicon, exhibit nucleating activity when they are in the form of oxides and salts (Pruppacher & Klett 1997; Wex, 2014). These elements present in our samples in high concentrations have undoubtedly caused the formation of these hailstones of large size and remarkable persistence over time.

In summary, the main results of the analyses of the hail samples indicate that:

- The physicochemical properties of the hail (pH, boiling, and freezing points) suggest a complex matrix with dissolved solutes.
- Visual and spectroscopic confirmation of the presence of microplastics (possibly polyester fibers) in the hail, with dimensions ranging between 0.5μ in diameter and 12 to 20μ in length.
- The most abundant elements in the samples are sodium, calcium, potassium, and magnesium, which exhibit high hygroscopicity, so they could collectively influence the formation of CCN and in INPs by forming the ice nuclei in clouds.

4. Conclusions:

The effects on the economy and health resulting from the silent and harmful ongoing climate engineering have been extensively studied and denounced for decades by physicists, physicians, scientists, and climate researchers around the world. In many countries, a large number of samples have been analyzed in soil, air, rainwater, hail, and snow, finding a high percentage of unusual chemical elements that do not naturally occur in the atmosphere, nor in industrial activities, nor originate from the Earth's own structure.

These results reinforce the importance of monitoring atmospheric precipitation as indicators of air quality and environmental pollution. The presence of microparticles, fibers, and toxic chemical elements in the hail raises questions about their sources, their atmospheric transport, and their potential impact on the environment and human health.

This report on the composition of the hail that fell in the town of Funes, Argentina, in the year 2025, is an initial exploratory study with a limited number of samples, but it lays the groundwork for conducting a greater number of analyses—of hail, soil, rivers, and rainwater alike—to confirm these trends that provide evidence of weather manipulation. These studies should be part of the obligations of governmental and public agencies to satisfy the public demand to restore the health of our atmosphere and our planet . The chronic inability of these very public agencies to respond adequately demands that accountability be accompanied by independent verification free from conflicts of interest.

In recent years, a portion of the Argentine citizenry, including ourselves, has requested Public Information regarding the origin of the aircraft spraying chemtrails, and we received no responses from the ANAC (National Civil Aviation Administration), just as municipal, provincial, and national Secretariats of the Environment also refused to provide answers.

This fierce attack that we are receiving from our skies must be stopped urgently, as it impacts our ecosystem (air, water, earth, living beings, and sunlight); the fact that the Sun is being "covered" by the toxic clouds generated by chemtrails is of utmost gravity. The Sun is our source of energy; having these "clouds" cover it affects fundamental processes for life, such as photosynthesis, metabolic reactions in the human body, animals, and microorganisms that depend on visible and UV light, pollination carried out by bees so that fertilization and fruit bearing can then occur—that is, it directly affects food production.

It is our responsibility as Sovereign human beings of the Argentine Territory to stop the geoengineering being carried out in our airspace and to condemn those responsible for this aberrant harm directed against the entire ecosystem.

References

Bayona, L. (2025) https://archive.org/details/informe-polvillo-lluvia-merlo-final

Beal, M., J.A., Rudke, A.P. et al. (2022). Chemical characterization of PM2.5 from region highly impacted by hailstorms in South America. Environ Sci Pollut Res 29, 5840–5851 https://doi.org/10.1007/s11356-021-15952-6

Beal, M., J.A., Rudke, A.P. et al. (2021) Evaluation of the chemical composition of hailstones from triple border Paraná, Santa Catarina (Brazil) and Argentina. Atmospheric Pollution Research 12, 184-192, https://doi.org/10.1016/j.apr.2021.01.009

Bernal Ayala, A.C., Rowe, A.K., Arena, L.E., Nachlas, W.O (2025) Physical–chemical properties of particles in hailstones from central Argentina, Atmos. Chem. Phys., 25, 7597–7617, https://doi.org/10.5194/acp-25-7597-2025

Carnicom, C.E (2005) https://carnicominstitute.org/conductivity-the-air-the-water-and-the-land/

Carnicom, C.E. (2015a) Secondary Rainwater Analysis : Organics & Inorganics. https://carnicominstitute.org/secondary-rainwater-analysis-organics-inorganics/

Carnicom, C.E. (2015b). Preliminary Rainwater Analysis: Aluminum Concentration https://carnicominstitute.org/preliminary-rainwater-analysis-aluminum-concentration/

Carnicom, C.E. (2016) The Demise of Rainwater. https://carnicominstitute.org/the-demise-of-rainwater/

Ćurić M. et al. (2013) Wet deposition of seeding agent after weather modification activities . Environ Sci Pollut Res.

Fajardo C. et al. (2014) Impact of Ag and Al2O3 nanoparticles on soil organisms: in vitro and soil experiments. Sci Total Environ.

Fajardo C., Costa G., Teniente Ortiz M., Nande, M.L. et al. (2016) Potential risk of acute toxicity induced by AgI cloud seeding on soil and freshwater biota. Ecotoxicology and Environmental Safety. Volume 133, 433-441

Geaves, M. (2025) https://www.ucl.ac.uk/news/2025/apr/geoengineering-technique-could-cool-planet-using-existing-aircraft

Geoen (2015) Climate Engineering Seeds Deadly Hail Storms https://geoengineeringwatch.org/climate-engineering-deadly-hail-storms/

Hobbs, P. (2000) Introduction to atmospheric chemistry, Cambridge University Press, 2000, p. 1 37.

Hobbs, P. (2000), Introduction to Atmospheric Chemistry, Cambridge University Press, p249.

Kelly J.T., Chuang C.C., Wexler A.S. (2007) Influence of dust composition on cloud droplet formation. Atmos Environ 41:2904–2916.

Kozjek M., Vengust D., Radošević N., et al. (2023) Dissecting giant hailstones: A glimpse into the troposphere with its diverse bacterial communities and fibrous microplastic. Science of The Total Environment,856, 15, 158786

Li, X., Zhang, Q., Zhu, T., Li, Z., Lin, J., Zou, T. (2018) Water-soluble ions in hailstones in northern and southwestern China. Science Bulletin, v.63, 1177- 1179. https://doi.org/10.1016/j.scib.2018.07.021

Lopez M.L.; Ceppi S.; Asar M.L.; Bürgesser R.; Avila, E. (2017) Analysis of the chemical composition of rainwater. Publisher and Place of Publication: Editorial Académica Española. ISBN: 978-1-873671-00-9

Geoengineering Monitor, 2026 https://map.geoengineeringmonitor.org/

NHMRC, NRMMC (2004) Australian drinking water guide-lines Canberra: National Health and Medical Re-search Council and Natural Resource Managment Minis-terial Council

Perfil, (2026) https://www.perfil.com/noticias/ciencia/la-nasa-detecto-un-fenomeno-inesperado-y-esperanzador-ante-el-deshielo-acelerado-de-la-antartida.phtml

Pelúas, M.G., Costantino, L.B., Oberti T.O. (2018) Rev. Iberoam. Polímeros y Materiales, 19(6), 271–282

Pruppacher H.R., Klett J.D. (1997) Microphysics of clouds and precipitation. Kluwer Academic Publishers , Dordrecht, the Netherlands

Samiha, R., Ahmed, M., Shohel, M., Salam, A. (2018) Chemical Composition and Source Characterization of Hailstones in Dhaka, Bangladesh. Journal of Geoscience and Environment Protection, 6, 71-82. doi: 10.4236/gep.2018.69006.

Santoyo, E., Garcia, R., Martínez-Frías, J., López-Verad, F., Verma, S.P. (2002) Capillary electrophoretic analysis of inorganic anions in atmospheric hailstone samples. J. Chromat. A, v.956, 279–286. https://doi.org/10.1016/S0021- 9673(02)00067-5.

Schaefer, V.J. (1948) Method of crystal formation and precipitation, US Patent US2527230A

Schüler S. (2024) What is the "cloud war," a new challenge for humanity? https://www.clarin.com/mundo/guerra-nubes-nuevo-desafio-humanidad_0_ibTVtYUkFC.html

Singh A. & Agrawal M. Acid rain and its ecological consequences. J Environ Biol. 2008 Jan;29(1):15-24. PMID: 18831326.

Sullivan R.C., Moore M.J., Petters M.D., et al., (2009) Effect of chemical mixing state on the hygroscopicity and cloud nucleation properties of calcium mineral dust particles. Atmos Chem Phys 9:3303–3316

Sustersic, C. (2024) https://www.conclusion.com.ar/info-general/estan-secando-la-estratosfera-la-geoingenieria-climatica-escribe-un-nuevo-capitulo/03/2024/

Water, S. (2024). Water standards, simulated rainwater. http://www.hps.net/simrain.html

Wex H., DeMott P.J., Tobo Y., Hartmann S., Rösch M., et al, (2014) Kaolinite particles as ice nuclei: learning from the use of different kaolinite samples and different coatings. Atmos Chem Phys 14(11):5529–5546. https://doi.org/10.5194/acp-14-5529-2014

Wex H., DeMott P.J., Tobo Y., Hartmann S., Rösch M., et al., (2014) Kaolinite particles as ice nuclei: learning from the use of different kaolinite samples and different coatings. Atmos Chem Phys 14(11):5529–5546. https://doi.org/10.5194/acp-14-5529-2014

Wigington, D. (2014). https://geoengineeringwatch.org/engineered-snowstorms-what-are-they-spraying/

Wigington, D. (2015). https://geoengineeringwatch.org/engineering-a-world-of-climate-extremes/

Wigington, D. (2024) Patent 3,613,992 Weather Modification Method. Government of the United States of America for Governmental.

Witkowska, D, Słowik, J. and Chilicka, K. (2021) Heavy Metals and Human Health: Possible Exposure Pathways and the Competition for Protein Binding Sites. Molecules 26(19):6060 .doi: 10.3390/molecules26196060. PMID: 34641604; PMCID: PMC8511997.

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