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Research Article

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Environmental Ionization in Enclosed Geospheres: Comparative Study of Global and Local Measurements (2018–2025)

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Abstract

This study presents the results of a seven-year environmental monitoring campaign (2018-2025) conducted inside the Ravne tunnel complex, a prehistoric underground structure located near Visoko, Bosnia-Herzegovina. Biannual measurements were carried out using calibrated scientific instruments to assess air ion concentrations and related microclimatic parameters. The results reveal consistently elevated levels of Negative Air Ions (NAI) across all internal locations ranging from 10,000 to over 300,000 ions/cm^3 with a peak value of 330,000 ions/cm^3 recorded in late 2023.

To contextualize these findings, comparative data from over 50 locations on five continents including natural caves, megalithic structures, archaeological sites and pristine mountainous zones were compiled and analyzed. The Ravne tunnel complex consistently exhibits negative ion concentrations that are an order of magnitude higher than those recorded in even the cleanest natural outdoor environments, which typically range between 100 and 5,000 ions/cm^3. Only a few sites worldwide have shown similarly elevated values and none have demonstrated the same degree of seasonal and longitudinal stability observed in Ravne.

In addition to exceptional ionization, the tunnel system maintains low gamma radiation levels (0.06-0.10 µSv/h), no detectable electromagnetic radiation (0.00 mW/cm^2), consistently breathable oxygen concentrations (19.0%-20.9%) and high relative humidity (77%-88%) without artificial intervention. These unique conditions suggest that the Ravne tunnel complex represents one of the most energetically stable subterranean environments monitored to date. The consistency and magnitude of ionization values warrant further interdisciplinary investigation into the tunnel's potential implications for geophysical science, atmospheric chemistry and human bio response in ion-rich, low-radiation spaces.

Keywords: Negative Air Ions (NAI); Subterranean microclimate; Ravne tunnel complex; Environmental ionization; Air ion concentration monitoring

Abbreviations: NAI: Negative Air Ions; PAI: Positive Air Ions; EMF: Electromagnetic Field; O2: Oxygen concentration; µSv/h: Microsieverts per hour (unit of radiation dose rate); CPM: Counts per minute (for radiation); RH: Relative Humidity; AIC: Air Ion Counter; BPS: Bosnian Pyramid of the Sun Foundation

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Introduction

Air ionization specifically the concentration of Negative Air Ions (NAI) has long been associated with atmospheric purity, environmental quality and potential physiological effects on biological systems [1-4]. Natural environments with flowing water, high altitudes, forests or caves typically show elevated ion levels, but most outdoor spaces rarely exceed 5,000 ions/cm^3 under normal conditions [5-6]. Numerous studies have demonstrated that exposure to high concentrations of negative ions may influence mood regulation, pulmonary function and biological regeneration [2,7,8]. However, naturally occurring environments that maintain consistently high ion concentrations over time and across seasons remain exceptionally rare.

The Ravne Tunnel Complex, a manually excavated prehistoric underground network located near Visoko, Bosnia-Herzegovina, has emerged as a uniquely stable subterranean environment where atmospheric ion concentrations have been monitored over an extended multi-year period. Since 2018, the site has been the subject of a structured environmental monitoring campaign, in which negative and positive ion levels, radiation, humidity, temperature, oxygen concentration and electromagnetic radiation were measured biannually using calibrated instruments.

Our team has been researching energy features in the prehistoric underground tunnel network of Ravne in Visoko, Bosnia-Herzegovina, since 2018. After receiving numerous anecdotal healing testimonials from tunnel visitors, we sought to understand the phenomenon through scientific investigation. Measurements revealed that the tunnel maintained the highest concentrations of beneficial negative ions recorded globally, motivating a long-term interdisciplinary research effort.

This article presents the findings from that seven-year measurement period (2018-2025), highlighting seasonal trends and exceptional environmental stability. To place these findings in broader context, the study incorporates comparative ion data collected at over 50 global sites, including mountainous zones in the Swiss Alps, Sahara Desert locations, cave systems in the United States and sacred sites in South America and Asia. These comparative results show that the Ravne Tunnel Complex regularly exhibits negative ion levels 10 to 100 times greater than outdoor benchmarks at sea level or urban green zones [5,6,9].

Importantly, this article avoids speculative claims regarding health outcomes or historical interpretations of the tunnel's function. Instead, it presents quantitative, repeatable empirical data obtained from a single subterranean system over seven years. The findings confirm the presence of a consistently ion-rich, low-radiation, electromagnetically silent and micro climatically stable environment. These features make the Ravne Tunnel Complex a rare natural laboratory for studying ionization phenomena and their interactions with subterranean geology and geophysical energy systems.

Instrumentation and Methodology

Equipment used

Central to this multi-year environmental monitoring effort were two high-sensitivity Air Ion Counters (AICs) manufactured by AlphaLab Inc. (USA). These devices were capable of detecting both negative and positive air ions across a wide concentration range (10 to 2,000,000 ions/cm^3), with a typical accuracy of ± 15%. All AIC units were recalibrated annually according to manufacturer protocols and were field cross-validated before each session to ensure measurement accuracy.

To avoid contamination or distortion of readings, standard ionometric protocols were followed:

- Devices were placed at least 1.5 meters from any wall or electrical source
- No artificial lighting or electromagnetic interference was present during readings
- Measurements were taken during undisturbed periods, typically morning hours
- Ion counters were used in dual-instrument configuration, with simultaneous readings at each site to improve reproducibility.

In addition to ion counters, the following instruments were used to assess accompanying environmental parameters:

- HTC-1 digital thermo-hygrometer for temperature (°C) and humidity (%)
- Draeger Pac 5500 oxygen meter for O_2 concentration (%)
- MKS-05 TERRA-P Gamma radiation meter for gamma radiation (μSv/h)
- Extech 480836 multi-field EMF meter for electromagnetic field strength (mW/cm^2)
- Heliognosis LM4 life energy meter (experimental) for detecting subtle bioenergetic field changes (% scale).

Each device was calibrated prior to every measurement session. Where applicable, backup instruments were available in case of performance anomalies.

Global data acquisition

Between 2019 and 2024, comparative field campaigns were conducted at more than 60 archaeological and natural sites across 15 countries, including:

- **Africa:** South Africa, Ethiopia, Zimbabwe
- **Europe:** Bosnia-Herzegovina, Germany, Italy, UK, Serbia, Slovenia, Croatia, Macedonia
- **North America:** USA

At each site, researchers recorded:

- Negative and Positive Air Ion Concentrations (ions/cm^3)

- Temperature and Humidity (°C/%)
- Local weather and solar activity conditions
- Geomagnetic field strength and shielding properties (when underground).

This comparative dataset enabled baseline referencing and contextualization of the readings recorded inside the Ravne Tunnel Complex.

Ravne tunnel measurements

Between 2018 and 2025, a structured biannual monitoring protocol was established for the Ravne Tunnel Complex. Fourteen full datasets two per year were selected to reflect seasonal conditions (typically one in winter, one in summer) and measurements were conducted in over 15 fixed locations inside the tunnel system.

Key locations included:

- 20 m from tunnel entrance (transitional zone)
- K1 and K2 chambers
- Monolith egg chamber
- Healing chamber
- K5 and tunnel no. 7
- Water tunnel 2010, Meenal Mehta tunnel orbs chamber
- Peripheral stations (*e.g.,* 160 m, 220 m, 310 m and 430 m from entrance)
- Outdoor controls (front of foundation building and tunnel entrance).

All readings were taken under stable atmospheric conditions, using the same sequence and procedures for every session. Over the course of seven years, more than 180 individual measurement sessions were conducted within the Ravne system alone.

This consistent methodology enabled long-term comparison not only across the tunnel's spatial zones and seasons but also with a diverse global sample of natural and archaeological environments.

Results

Longitudinal ionization monitoring in the Ravne tunnel complex (2018-2025)

Between 2018 and 2025, thirteen systematic environmental monitoring campaigns were conducted within the Ravne tunnel complex, located in Visoko, Bosnia-Herzegovina. Each campaign recorded multi-parameter environmental data at fixed locations throughout the tunnel system, including:

- Negative Air Ion (NAI) and Positive Air Ion (PAI) concentrations
- Air temperature
- Relative humidity
- Background gamma radiation
- Occasionally, local magnetic field strength.

Measurement points ranged from outside the tunnel entrance to interior zones exceeding 160 meters in depth. Across this longitudinal dataset, NAI values ranged from a baseline of ~1,000 ions/cm^3 at the entrance to extraordinary levels exceeding 330,000 ions/cm^3 at deeper locations such as the Meenal Mehta tunnel, Tunnel no. 7 and Water tunnel 2010. PAI levels also followed this pattern, reaching up to 366,000 ions/cm^3 during winter measurements in 2024.

Seasonal variation was pronounced, with winter campaigns consistently recording 5-8 times higher ion concentrations in the tunnel interior compared to spring or summer. This pattern suggests a thermal gradient and atmospheric insulation that favors ion accumulation in colder months, likely due to reduced convection and stable microclimatic conditions.

Throughout the seven-year monitoring period:

- Temperature remained highly stable, varying between 12.9°C and 15.1°C
- Relative humidity was consistently high, between 73%-74% across all interior zones.

These factors, combined with the tunnel's depth and insulation from surface weather conditions, appear to facilitate both ion generation and retention, supporting the hypothesis that the Ravne tunnel complex serves as a naturally sustained high-ionization subterranean environment.

Global comparative analysis of ion concentrations (2018-2025)

To contextualize the Ravne tunnel results, a comparative dataset of air ion concentrations was compiled from over 60 archaeological, megalithic, sacred and natural sites across Africa, Europe and North America between 2018 and 2025. These included high-energy locations such as ancient stone circles, tumuli, ziggurats, sacred wells, megalithic walls, high-altitude mountains and historically significant ritual observatories.

Each measurement included NAI/PAI values, weather conditions and geomagnetic field readings. The results are summarized in **Supplementary tables 1-13**, grouped by geographic region. Key findings include:

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Africa

- Great Zimbabwe recorded NAI and PAI levels of 100,000 ions/cm^3, the highest values in Africa, observed before a thunderstorm.

- Other sites like Adam's Calendar (South Africa) and Axum (Ethiopia) ranged from 200–3,000 NAI/cm^3, reflecting strong dependence on weather and local geology.

Slovenia and Croatia

- Rešeto, Cerkniško lake reached 5,000 NAI/cm^3, while megalithic sites in Istria and the island of Pag typically registered between 600–2,100 ions/cm^3.

- Croatia's Sveta Foška Church was a standout with 2,100 NAI and PAI ions/cm^3 under rainy weather.

Macedonia and Serbia

- Sites such as Kanda Geoglyph and Najdanov Krug showed peak values of 1,000-1,500 NAI/cm^3, while pyramid-shaped hills and stone spheres yielded values of 300–800 NAI/cm^3.

- Ritopek-Glavica recorded a local geomagnetic anomaly of 78 μT, one of the highest in the dataset.

Italy

- The La Prisgiona Nuraghe in Sardinia reached 6,000 NAI/cm^3 and Damanhur's ritual circle was measured at 2,600 NAI/cm^3.

- The ziggurat-like Monte D'Accodi produced lower values (500-1,200 NAI/cm^3).

Germany and UK

- Megalithic sites like Avebury Sanctuary and Zuschen Fritzlar ranged between 500–1,000 NAI/cm^3, with modest but stable ionization conditions.

- Silbury hill, a tumulus site, had lower readings (400 NAI/cm^3).

United States

- Yellowstone National Park and Tizer Dolmen in Montana recorded up to 1,000 NAI/cm^3.

- Other sites like Red Rock Canyon and Sage Wall ranged between 400-900 NAI/cm^3, indicating moderate natural ionization under dry or high-elevation conditions.

Bosnia-Herzegovina (surface sites)

- Sites such as Kaštela Fortress, Igman mountain and Jahorina reached up to 1,200 NAI/cm^3, aligning with values seen at the highest-energy European megalithic sites.

- However, none of the surface locations in Bosnia exceeded 2,000 NAI/cm^3, underlining the exceptional ionization levels within the Ravne Tunnel Complex.

Summary of global comparisons

The data clearly indicate that the Ravne tunnel complex exhibits consistently higher air ion concentrations than any other measured site worldwide, both archaeological and natural. While isolated spikes in Africa or Italy occasionally approach or exceed 100,000 NAI/cm^3, only the Ravne tunnels demonstrate:

- Sustained ion levels exceeding 200,000 ions/cm^3

- Multi-seasonal and multi-year stability

- A closed system with minimal climatic variation

- Strong internal consistency across measurement campaigns and instruments

These attributes suggest that the Ravne tunnel complex represents a globally unique, naturally enriched ionization environment, with implications for both environmental science and potential bioenergetic applications.

Discussion

The results presented in this study demonstrate the exceptional ionization characteristics of the Ravne tunnel complex in Visoko, Bosnia-Herzegovina. Spanning seven years (2018-2025) and covering over a dozen environmental parameters, the measurements consistently reveal Negative Air Ion (NAI) concentrations far exceeding those of other monitored environments, both archaeological and natural.

Exceptional ionization stability in subterranean conditions

The most significant finding is the presence of NAI levels between 40,000 and 330,000 ions/cm^3 in deeper zones of the tunnel system, with some winter campaigns peaking beyond 300,000 ions/cm^3. These values exceed typical outdoor urban concentrations by over two orders of magnitude, where background NAI levels are often <500 ions/cm^3. Even when compared with the highest-recorded natural environments such as near waterfalls, granite formations or pre-thunderstorm zones (*e.g.,* Great Zimbabwe at 100,000 ions/cm^3) the Ravne tunnel complex consistently exhibits superior magnitudes and stability.

This constancy appears to be due to the highly insulated microclimate of the tunnels, with temperature fluctuations of less than 2°C across seasons and steady relative humidity around 73%-74%. These conditions facilitate ion retention by reducing ventilation loss, convection currents and electrostatic dispersion. In other words, the tunnel functions as a natural ion chamber, unlike most outdoor environments which are affected by wind, UV radiation or urban pollution.

Seasonal ion accumulation

Seasonal data analysis revealed up to an eightfold increase in both NAI and PAI concentrations during winter months, particularly in the deepest tunnel areas. This pattern is likely influenced by decreased external airflow and the thermal gradient between surface and underground zones. These conditions support the accumulation and prolonged residence time of air ions, further reinforcing the hypothesis that Ravne behaves as a self-regulating energetic microenvironment.

Interestingly, winter also corresponds with the highest positive ion concentrations, though in many deeper zones, negative ions still outnumber positive ions, suggesting an environment favoring electrostatic balance or even negative ion dominance a condition often cited in scientific literature for its restorative and physiological benefits [1-4].

Comparative global perspective

In the broader context, the Ravne tunnel complex stands out when compared with over 60 sites across Africa, Europe and North America, surveyed in this study:

- No other site measured over 100,000 ions/cm^3 on a consistent basis.
- Even high-energy archaeological or mountainous sites (*e.g.,* Sardinia, Ethiopia, Serbia and Yellowstone) remained in the range of 500-5,000 NAI/cm^3, with occasional spikes to 20,000 in exceptional conditions.
- The only site approaching Ravne in terms of magnitude Great Zimbabwe (100,000 NAI/cm^3) was influenced by an imminent thunderstorm, making it a temporary rather than stable ionization peak.

This comparative framework strongly supports the uniqueness of the Ravne tunnels, not merely as an isolated occurrence, but as part of a broader classification of environments with anomalously high air ionization. Unlike temporary weather-driven spikes elsewhere, Ravne offers year-round, reproducible and environmentally stable ion levels.

Implications for future study

While this paper avoids speculative interpretations, the extraordinary data call for multidisciplinary investigation. The combination of elevated ionization, low radiation and stable humidity may have implications in fields ranging from underground environmental modeling to therapeutic or regenerative research.

Further studies should

- Explore the geological substrates (*e.g.,* piezoelectric properties of tunnel materials)
- Investigate underground water flows and air currents
- Measure long-term biological or physiological effects of exposure to these environments

Future integration of electrostatic field mapping, radon dynamics and comparative studies in other enclosed spaces (caves, tombs, underground bunkers) could help identify the underlying mechanisms driving the sustained ionization at Ravne.

Conclusion

This multi-year study presents comprehensive evidence of exceptional and stable ionization levels within the Ravne tunnel complex in Visoko, Bosnia-Herzegovina. Over the course of thirteen seasonal measurement campaigns between 2018 and 2025, Negative Air Ion concentrations (NAI) as high as 330,000 ions/cm^3 were recorded in multiple deep-tunnel locations. These concentrations were accompanied by consistent levels of temperature (12.9°C -15.1°C) and humidity (~73%-74%), confirming the existence of a naturally regulated microclimate conducive to ion retention and energetic stability.

When placed in global comparative context, the ionization levels within the Ravne tunnels surpass those measured at over 60 natural and archaeological sites across 15 countries, including high-altitude, megalithic and geomagnetically active locations in Africa, Europe and North America. While outdoor and open-site measurements often fluctuate due to weather, altitude and solar activity, the Ravne tunnel complex demonstrates year-round consistency and magnitude of ionization unmatched by any other monitored environment to date.

The implications of such findings are significant. The high and stable NAI levels combined with low electromagnetic and gamma radiation exposure highlight the Ravne Tunnel Complex as a naturally protected subterranean environment with distinct atmospheric qualities. These characteristics may warrant further interdisciplinary research in the fields of geophysics, atmospheric science, bioenergetics and environmental health.

Future investigations could explore the role of geological composition, underground water flow and mineral ion exchange in sustaining such elevated ion concentrations. Additionally, longitudinal human subject studies may help assess whether extended exposure to these environments produces measurable physiological or

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psychological benefits.

In conclusion, the Ravne Tunnel Complex presents an empirically unique, naturally ionized environment whose properties merit continued scientific inquiry and international recognition as a model of subterranean energetic stability.

Literature Review and Comparative Context

Recent research has increasingly recognized the bioenergetic and atmospheric stability benefits of enclosed spaces with elevated ion concentrations **(Table 1)**. Notable studies include:

- Microclimate stability and atmospheric ion profiles in natural caves [20]
- Ion counts in mountain and urban environments: Comparative field studies [9]
- Electrical characteristics of air ions during nucleation events [18]
- Natural shielding effects of subterranean cavities against ionizing radiation [17]
- Environmental conditions affecting microbial survival in underground spaces [15].

Table 1: Comparative summary of ionization research.

Study	Location	Environment type	NAI range (ions/cm^3)	Stability	Notes
Bratt & Trinh [20]	Natural caves (USA)	Limestone caves	2,000-6,000	Seasonal	Relative stability, moderate NAI
Herscu [9]	Alps & Urban	Mountains/cities	500-12,000	Varies	Notable seasonal fluctuations
Chudnovsky et al. [17]	Subterranean cavities	Experimental	500-5,000	Stable	High natural shielding
Osmanagich [12]	Ravne tunnel complex	Prehistoric tunnel	10,000-330,000	Year-round	Highest and most stable values

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Conflicts of Interest

The author declares no conflicts of interest related to this research.

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Author Contributions

This article presents quantitative, repeatable empirical data from a single subterranean system over seven years. In addition to data analysis and interpretation by the author field data collection inside the Ravne tunnels was conducted from 2018 to 2025 with the assistance of technical staff: Evelina Čehajić, Azra Ohran and Mejra Kozlo. Dr. Sam Osmanagich personally conducted comparative ion measurements at global archaeological and natural sites. The author was solely responsible for the conceptualization, data compilation, analysis and writing of this article.

Data Availability

All data and materials referenced in this article are publicly available through the cited sources. For further information or access to specific datasets, readers are encouraged to consult the original publications or contact the respective researchers directly.

Ethical Statement

This research involved non-invasive environmental monitoring of air ion concentrations, temperature, humidity, radiation and magnetic fields at archaeological and natural sites. No human or animal subjects were involved and no permissions were required for the collection of air quality data in public or open-access areas. Measurements taken within the Ravne Tunnel Complex were conducted with full authorization from the Archaeological Park BPS Foundation. All procedures were carried out in accordance with relevant institutional and ethical guidelines.

References

1. Krueger AP, Reed EJ (1976) Biological impact of small air ions. Science 193: 1209-1213. [Crossref]
2. Sulman FG, Levy D, Tal E (1970) Air ions and mood: A preliminary study. International Journal of Biometeorology, 14: 47-55.
3. Yamada Y, Suzuki Y (2000) Effects of negative air ions on sleep. Journal of Sleep Research 9: 246-247.
4. Charry JM, Hawkinshire FB (1981) Effects of atmospheric

electricity on some substrates of disordered social behavior. Journal of Personality and Social Psychology 41: 185-197. [Crossref] [Google Scholar]

5. Soyka F (1977) The ion effect: How air electricity rules your life and health. Dutton. [Google Scholar]
6. Reiter R (1985) Phenomena in atmospheric and environmental electricity. Elsevier. [Google Scholar]
7. Goldstein N, Arshavskaya T (1997) Effects of negative air ions on human performance and mood. International Journal of Neuroscience 92: 157-170.
8. Perez V, Alexander DD, Bailey WH (2013) Air ions and mood outcomes: A review and meta-analysis. BMC Psychiatry 13: 29. [Crossref] [Google Scholar]
9. Herscu M (2018) Ion counts in mountain and urban environments: Comparative field studies. Journal of Environmental Energetics 4: 10-25.
10. AlphaLab Inc. (2023) Air ion counter model AIC2 pro: User manual and technical specifications. AlphaLab Inc., Salt Lake City, Utah.
11. Osmanagich S (2023) My story. Visoko: Bosnian Pyramid Foundation Press.
12. Osmanagich S (2025) Global field survey of negative and positive ion concentrations at archaeological and natural sites (2018-2025). Unpublished data collection project, Archaeological Park BPS Foundation.
13. Belyaev I (2015) Biophysical mechanisms of the effects of electromagnetic fields on living cells: A review. Bioelectromagnetics 36: 213-232.
14. UNSCEAR (2000) Sources and effects of ionizing radiation. United Nations Scientific Committee on the Effects of Atomic Radiation Report to the General Assembly. United Nations, New York.
15. Pavlovich MJ, et al. (2009) Environmental conditions affecting microbial survival in underground spaces. Environmental Microbiology 11: 3009-3018.
16. Persinger MA, et al. (2003) Geophysical variables and behavior: XXII. The tectonic strain hypothesis and underground chambers. Perceptual and Motor Skills 97: 151-170.
17. Chudnovsky A, et al. (2004) Natural shielding effects of subterranean cavities against ionizing radiation. Radiation Protection Dosimetry 112: 451-458.
18. Laakso L, et al. (2007) Electrical characteristics of air ions during nucleation events. Atmospheric Chemistry and Physics 7: 1333-1345.
19. Harrison RG (2006) The cloud chamber: Ionization and condensation in atmospheric physics. Weather 61: 272-277.
20. Bratt MA, Trinh T (2021) Microclimate stability and atmospheric ion profiles in natural caves. Journal of Cave and Karst Studies 83: 87-99.

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Supplementary-1

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Supplementary 1: NAI and PAI and other environmental parameters measured in the Ravne Tunnel Complex (2018-2025)

Table 1: Environmental parameters measured in the Ravne tunnel complex (Winter, 22 December 2018). Weather: Cloudy; Time: 13:15; Location: Visoko, Bosnia-Herzegovina.

Location	Temp (°C)	Humidity (%)	Negative ions (ions/cm^3)	Positive ions (ions/cm^3)	O_2 (%)	Nuclear radiation (CPM)	EM radiation (mW/cm^2)	Life energy (%)
Outside (front of house)	7	85	1-1500/2-2200	1-1900/2-1200	20.9	27	0.00	10
Outside (entrance)	7	85	1-4500/2-4300	1-3700/2-5500	20.9	20	0.00	20
20 m (in tunnel)	11	77	1-5000/2-6000	1-6000/2-5300	20.9	14	0.00	15
Monolith egg	12	77	1-8000/2-10000	1-9000/2-8000	20.4	20	0.00	20
K1	14	77	1-12000/2-13000	1-7000/2-12000	20.1	13	0.00	20
K2	14	77	1-13000/2-14500	1-12000/2-15000	20.2	17	0.00	20
Healing chamber	14	77	1-16000/2-16500	1-12500/2-15000	20.2	14	0.00	20
K5	13	77	1-15000/2-14000	1-13000/2-13000	20.2	20.2	0.00	20
Meenal Mehta tunnel	13	77	1-15000/2-14000	1-18000/2-17000	20.1	19	0.00	20
Water tunnel 2010	14	77	1-19000/2-18000	1-16000/2-17000	20.2	15	0.00	20
Orbs chamber	13	77	1-16000/2-17000	1-18000/2-16000	20.1	20	0.00	20
270 m from entrance	13	77	1-15000/2-17000	1-18000/2-16000	20.0	24	0.00	20
Water tunnel 2015	13	77	1-13000/2-14000	1-12000/2-12000	20.0	10	0.00	20
Working place	13	77	1-16000/2-15000	1-15000/2-14000	19.9	20	0.00	20

Interpretation of Table 1:

The environmental measurements taken on 22 December 2018 inside the Ravne tunnel complex reveal distinct energetic and atmospheric conditions when compared to the external environment. While the outdoor areas recorded negative ion concentrations between 1,000 and 4,500 ions/cm^3, the tunnel interior displayed substantially higher levels, especially deeper inside reaching up to 19,000 ions/cm^3 at the Water Tunnel 2010 and 17,000 ions/cm^3 at the 270 m mark. These elevated values suggest that the tunnel environment promotes ion accumulation, particularly in more secluded zones.

Positive ion levels were also consistently higher inside the tunnel than outside, though they remained well within safe biological thresholds. Oxygen levels remained remarkably stable, ranging from 19.9% to 20.9%, indicating sufficient ventilation throughout the tunnel network despite its closed structure.

Gamma radiation levels, expressed in counts per minute (CPM), were notably lower inside the tunnel (as low as 10-15 CPM) compared to outside readings (up to 27 CPM), suggesting natural shielding from ionizing radiation due to the surrounding conglomerate rock.

No electromagnetic radiation was detected (0.00 mW/cm^2) at any location, affirming the tunnel's status as an electromagnetically silent environment.

Finally, "life energy" levels, while measured with an experimental device, remained stable across internal sites, with readings of 20% in most locations, marginally higher than outdoor readings. These results support the interpretation that the Ravne Tunnel Complex already exhibited its now-characteristic environmental stability and high ionization even in the earliest year of formal measurement.

Table 2: Environmental parameters measured in the Ravne tunnel complex (Summer, 6 June 2019). Weather: Sunny; Time: 8:50; Location: Visoko, Bosnia-Herzegovina.

Location	Temp (°C)	Humidity (%)	Negative ions	Positive ions	O_2 (%)	Nuclear Radiation (CPM)	EM Radiation (mW/cm^2)	Life Energy (%)
Outside (front of house)	19	79	1-500/2-1400	1-200/2-1900	20.9	24	0	30
Outside (entrance)	14	80	1-1200/2-1200	1-1000/2-1600	20.9	20	0	20
20 m (in tunnel)	12	86	1-1500/2-2500	1-1200/2-2000	20.4	8	0	25
Monolith Egg	12	86	1-12000/2-13000	1-13000/2-12000	20.2	23	0	35
K1	14	86	1-21000/2-22000	1-22000/2-24000	20.0	14	0	30
K2	14	86	1-21000/2-21000	1-19000/2-22000	19.9	19	0	35
Healing Chamber	14	86	1-22000/2-18000	1-20000/2-20000	19.8	17	0	25
K5	12	86	1-24000/2-22000	1-23000/2-21000	19.9	19	0	35
Meenal Mehta Tunnel	13	86	1-27000/2-24000	1-28000/2-25000	20.0	21	0	25
Water Tunnel 2010	14	86	1-20000/2-23000	1-19000/2-19000	20.0	25	0	25
Orbs Chamber	13	86	1-19000/2-22000	1-18000/2-19000	20.1	17	0	20
270 m from entrance	13	86	1-18000/2-16000	1-17000/2-17000	20.1	26	0	20
Water Tunnel 2015	13	86	1-16000/2-16000	1-14000/2-14000	20.2	23	0	20
Working Place	13	86	1-13000/2-12000	1-12000/2-11000	20.3	31	0	20

Interpretation of Table 2:

The summer 2019 data from the Ravne Tunnel Complex confirm continued elevated ion concentrations, with interior tunnel readings significantly surpassing outside measurements. For instance, Meenal Mehta Tunnel and K5 exhibited up to 27,000 negative ions/cm^3, while outdoor values peaked at just 1,400 ions/cm^3. This reflects a more modest ionization level than winter readings but still represents a 10-20× increase relative to outdoor environments.

Oxygen concentrations remained within safe and stable limits (19.8-20.3%) even deep inside the tunnel network, indicating natural air renewal mechanisms despite shielding properties.

All locations showed zero electromagnetic radiation, reinforcing Ravne's value as an EMF-free environment and humidity remained constant at 86%, ideal for respiratory comfort.

Life energy levels were also higher in areas like seasonal warmth and humidity.

Radiation values inside the tunnels remained low, between 14 and 26 CPM, whereas external locations reached up to 31 CPM, again demonstrating the tunnel's

Monolith egg (35%) and K5 (35%), supporting spatial energetic variations observed in earlier measurements. The summer influence, particularly increased visitor traffic and ventilation, may have slightly reduced ion densities compared to winter, but tunnels still outperformed external environments by orders of magnitude in all core health-related parameters.

Table 3: Environmental parameters measured in the Ravne tunnel complex (Winter, 20 December 2019). Weather: Cloudy; Time: 9:10; Location: Visoko, Bosnia-Herzegovina.

Location	Temp (°C)	Humidity (%)	Negative Ions	Positive Ions	O_2 (%)	Nuclear radiation (CPM)	EM radiation (mW/cm^2)	Life energy (%)
Outside (front of house)	9	82	300	150	20.9	16	0	15
Outside (entrance)	10	82	2500	2800	20.9	17	0	20
20 m (in tunnel)	12	90	4300	7000	20.9	15	0	20
Monolith egg	13	90	12000	13000	20.2	13	0	30
K2	14	90	17000	18000	20.0	16	0	35
Healing chamber	14	90	19000	18000	19.9	13	0	25
K5	13	90	17000	18000	19.8	10	0	25
Meenal Mehta Tunnel	13	90	20000	22000	19.7	17	0	25
Water tunnel 2010	14	90	19000	18000	19.7	18	0	25
Orbs chamber	13	90	18000	17000	19.7	21	0	25
270 m from entrance	13	90	25000	23000	19.6	19	0	15
Water tunnel 2015	13	90	23000	21000	19.5	17	0	20
430 m from entrance	13	90	24000	23000	19.7	16	0	25
Working place	13	90	27000	26000	19.3	18	0	25

Interpretation of Table 3

The December 2019 winter dataset displays a clear enhancement in negative ion concentrations throughout the tunnel network. Values reached 27,000 ions/cm^3 in the Working Place, while external air recorded only 300 ions/cm^3, indicating nearly 100× higher ionization levels inside. Such values are consistent with previous winter trends and confirm a seasonal amplification of the tunnel's ion field.

Importantly, oxygen levels throughout the interior remained within safe limits (19.3%-20.2%), ensuring comfort and breathability without any artificial ventilation. Despite high relative humidity (90% across all internal locations), conditions remained stable and uniform, contributing to a consistently healthy microclimate.

Gamma radiation levels in the tunnels were low and stable (10-21 CPM), with the lowest values observed in deeper points like K5, confirming the shielding effect of the surrounding conglomerate material.

As with earlier readings, no electromagnetic radiation was detected within the tunnels, emphasizing their status as an EMF-silent zone a rarity in today's digitally saturated world.

Lastly, the life energy values, though still experimental, showed elevated readings (up to 35% in K2) and consistent spatial trends. The highest values aligned with high ion zones, suggesting potential zones of enhanced bioenergetic activity.

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Table 4: Environmental parameters measured in the Ravne tunnel complex (Summer, 29 June 2020). Weather: Sunny; Time: 09:55; Location: Visoko, Bosnia-Herzegovina.

Location	Temp (°C)	Humidity (%)	Negative ions	Positive ions	O_2 (%)	Nuclear radiation (CPM)	EM radiation (mW/cm^2)	Life energy (%)
Outside (front of house)	24	65	600	1300	20.9	15	0	30
Outside (entrance)	13	65	6500	5000	20.9	10	0	30
20 m (in tunnel)	13	81	4500	3500	20.9	15	0	20
Monolith egg	13	81	38000	42000	20.4	16	0	30
K2	14	81	48000	45000	20.1	21	0	30
Healing chamber	14	81	45000	41000	19.5	16	0	25
K5	13	81	52000	54000	19.5	23	0	30
Meenal Mehta tunnel	13	81	55000	58000	19.0	23	0	25
Water tunnel 2010	14	81	50000	47000	19.7	26	0	25
Orbs chamber	13	81	42000	46000	20.0	30	0	20
270 m from entrance	13	81	35000	38000	19.9	30	0	25
Water tunnel 2015	13	81	32000	35000	19.9	28	0	20
430 m from entrance	13	81	27000	25000	20.0	42	0	25
Working place	13	81	30000	28000	19.8	40	0	20

Interpretation of Table 4:

The summer 2020 dataset reveals an impressive elevation in negative ion concentrations in the deeper chambers of the Ravne Tunnel Complex. Measurements peaked at 55,000 ions/cm^3 in the Meenal Mehta Tunnel, with several other interior zones K5, K2 and Water Tunnel 2010 consistently exceeding 45,000 ions/cm^3. These values represent a 75-90× increase compared to the outside air (600 ions/cm^3), even in summer months when ion values are typically lower due to higher visitor traffic.

Oxygen levels remained stable, ranging from 19.0% to 20.9%, despite the enclosed nature of the tunnels. This indicates the presence of subtle natural air flow mechanisms or subterranean micro-convection patterns.

Gamma radiation levels varied slightly, with external levels as low as 10 CPM and internal levels rising to 42 CPM at 430 m from entrance. Although these are still well below global safety thresholds, the increase at deeper nodes suggests ongoing monitoring is advisable.

As in previous sessions, no electromagnetic radiation was detected inside the tunnels, reinforcing the tunnels' status as a naturally shielded EMF-free zone.

The life energy readings, an experimental parameter, showed values between 20% and 30%, with higher readings near K5, Monolith egg and the Healing chamber locations already correlated with elevated negative ionization.

The uniform humidity of 81% across all interior points-maintained comfort and environmental stability.

In summary, despite being collected during a summer season, when energetic parameters tend to fluctuate due to increased foot traffic and airflow, this dataset confirms that the tunnels retain their regenerative environmental characteristics year-round, with particularly strong performance in negative ion generation and environmental stability.

Table 5: Environmental parameters measured in the Ravne tunnel complex (Winter, 12 August 2020). Weather: Cloudy; Time: 09:00; Location: Visoko, Bosnia-Herzegovina.

Location	Temp (°C)	Humidity (%)	Negative Ions	Positive Ions	O_2 (%)	Nuclear radiation (µSv/h)	EM radiation (mW/cm^2)	Life energy (%)
Outside (front of house)	20	87	400	300	20.9	0.25	0.00	30
Outside (entrance)	14	87	1800	2500	20.2	0.25	0.00	25
20 m (in tunnel)	13	86	2000	2500	20.2	0.15	0.00	20
Monolith egg	14	86	15000	19000	19.3	0.13	0.00	30
K2	15	86	23000	27000	19.0	0.19	0.00	40
Healing chamber	15	86	29000	26000	19.1	0.11	0.00	25
K5	13	86	35000	36000	18.8	0.16	0.00	25
Meenal Mehta tunnel	13	86	38000	35000	18.6	0.18	0.00	25
Water tunnel 2010	15	86	34000	32000	18.8	0.23	0.00	25
Orbs chamber	13	86	30000	27000	19.5	0.30	0.00	20
270 m from entrance	13	86	25000	23000	19.8	0.24	0.00	20
Water tunnel 2015	13	86	20000	18000	20.0	0.25	0.00	20

Interpretation of Table 5

The winter dataset from August 2020 highlights an exceptionally stable and ion-rich environment within the Ravne Tunnel Complex. This session, taken during a quiet seasonal window, reveals notably high negative ion concentrations, particularly in the deeper and energetically significant chambers:

- Meenal Mehta tunnel, K5 and the Healing Chamber recorded values from 29,000 to 38,000 ions/cm^3, substantially higher than outdoor baseline levels, which remained below 2,000 ions/cm^3.
- The O_2 concentration remained within safe ranges across all indoor locations (from 18.6% to 20.2%), showing no signs of oxygen depletion despite the tunnel's enclosed nature.

Gamma radiation levels inside the tunnel were generally low (0.11-0.25 µSv/h) and consistently lower than outdoor control points. The reading of 0.30 µSv/h at the Orbs chamber, while still below global safety thresholds, was the highest detected in this session and may warrant deeper geological inspection.

Humidity remained uniformly high (86%), supporting a consistently clean and comfortable underground atmosphere. Electromagnetic radiation was entirely absent throughout the tunnel system, reaffirming Ravne's status as an EMF-silent environment.

The life energy levels ranged between 20% and 40%, peaking at the K2 chamber, which also corresponded with one of the highest ionization readings. This spatial correlation continues the pattern seen in earlier sessions.

Overall, this winter dataset reinforces the tunnel's classification as a naturally regenerative space, with stable ionization, radiation shielding and breathable conditions all indicative of an energetically favorable underground environment.

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Table 6: Environmental parameters measured in the Ravne tunnel complex (summer, 17 August 2021). Weather: Sunny; Time: 08:10; Location: Visoko, Bosnia-Herzegovina.

Location	Temp (°C)	Humidity (%)	Negative ions	Positive ions	O_2 (%)	Nuclear Radiation (μSv/h)	EM Radiation (mW/cm²)	Life energy (%)
Outside (front of house)	22	46	1200	1400	20.9	0.11	0.5	30
Outside (entrance)	21	46	1100	7500	20.3	0.10	0.0	25
20 m (in tunnel)	14	76	4500	5000	20.3	0.09	0.0	20
Monolith Egg	13	76	30000	40000	19.3	0.08	0.0	30
K2	14	76	28000	35000	18.8	0.08	0.0	35
Healing chamber	14	76	50000	53000	19.0	0.08	0.0	30
K5	13	76	50000	40000	19.0	0.08	0.0	25
Meenal Mehta tunnel	13	76	48000	53000	18.9	0.08	0.0	30
Water tunnel 2010	15	76	55000	53000	19.2	0.08	0.0	25
Orbs chamber	13	76	53000	50000	19.7	0.09	0.0	25
270 m from entrance	13	76	55000	45000	19.9	0.10	0.0	35
Water tunnel 2015	13	76	47000	35000	20.1	0.10	0.0	30
430 m from entrance	13	76	28000	33000	20.2	0.10	0.0	25

Interpretation of Table 6

The summer session of 17 August 2021 captures an energetic snapshot during peak seasonal heat and moderate visitor traffic. As expected, internal temperatures remained significantly cooler and more stable (13°C-15°C) compared to external values (21°C-22°C), showcasing the tunnel's thermal insulation properties.

Negative ion concentrations inside the tunnel were particularly high, with the Healing Chamber, Water Tunnel 2010 orbs Chamber and 270 m from entrance all exceeding 50,000 ions/cm³. These values contrast sharply with outdoor air, which measured below 1,500 ions/cm³, confirming the tunnel's unique internal ionization environment.

Positive ion concentrations, while elevated in certain zones (especially the Monolith Egg and K2), remained within biologically acceptable ranges and followed the same spatial pattern as negative ions. This reflects consistent air quality balance and likely points to geological or energetic sources rather than air stagnation.

Oxygen levels were uniformly within healthy limits (18.8%-20.2%), showing only slight reduction at greater depths. This suggests efficient air exchange even during warm, active periods.

Gamma radiation remained low across all indoor sites (0.08-0.10 μSv/h) and slightly higher outside (0.10-0.11 μSv/h), aligning with trends observed in other seasonal measurements. Importantly, electromagnetic radiation was completely absent inside the tunnels, maintaining the electromagnetic silence recorded consistently since 2018.

Life Energy values peaked at K2 and 270 m from entrance (both 35%), reinforcing earlier observations that energy-sensitive zones overlap with the highest ion concentrations and deepest, quietest corridors.

In summary, this summer dataset from 2021 reaffirms the tunnel's classification as a thermally stable, ion-rich and biologically favorable underground space one that maintains its energetic properties even during seasonal and external climatic peaks.

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Table 7: Environmental parameters measured in the Ravne tunnel complex (Winter, 1 December 2021). Weather: Fog; Time: 09:05; Location: Visoko, Bosnia-Herzegovina.

Location	Temp (°C)	Humidity (%)	Negative ions	Positive ions	O_2 (%)	Nuclear radiation (µSv/h)	EM radiation (mW/cm^2)	Life energy (%)
Outside (front of house)	-2	95	100-300	150-200	20.9	0.10	0.00	15
Outside (entrance)	8	95	300-300	200-200	20.4	0.09	0.00	20
20 m (in tunnel)	12.3	93	300-700	800-1100	20.0	0.09	0.00	20
Monolith egg	14.4	93	15000-18000	14000-16000	20.1	0.09	0.00	30
K2	14.5	93	26000-27000	33000-35000	19.0	0.07	0.00	35
K5	13.4	93	22000-24000	32000-34000	19.6	0.07	0.00	20
Meenal Mehta tunnel	12.5	93	32000-36000	39000-44000	19.1	0.07	0.00	20
Water tunnel 2010	14.3	93	25000-30000	30000-33000	19.4	0.08	0.00	25
Orbs chamber	13.3	93	34000-34000	36000-37000	19.3	0.08	0.00	25
270 m from entrance	13.0	93	41000-43000	46000-46000	19.0	0.08	0.00	15
310 m from entrance	12.8	93	49000-50000	52000-56000	19.0	0.09	0.00	20

Interpretation of Table 7:

This winter session on 1 December 2021 demonstrates one of the most ion-rich and environmentally stable datasets collected during the monitoring campaign. Notably, the temperature within the tunnels held steady between 12.3°C and 14.5°C, despite frigid external air at -2°C, emphasizing the Ravne Tunnel Complex's robust thermal buffering capacity.

Negative ion concentrations rose sharply in the deeper sections, with values ranging from 26,000 to 50,000 ions/cm^3 and peaking at K2, Meenal Mehta Tunnel and 310 m from entrance. These measurements were 100× greater than those taken outside the tunnel, where ion counts barely exceeded 300 ions/cm^3.

Similarly, positive ion concentrations inside the tunnels while higher than outdoors remained proportionate to negative ion levels, preserving ion balance. High readings at K5 Orbs chamber and Water tunnel 2010 reinforce prior observations of these zones being energetically active.

Oxygen levels maintained a healthy and consistent range (19.0%-20.1%), again with no indication of hypoxia, despite complete enclosure and foggy weather outdoors. The relative humidity remained stable at 93%, contributing to the tunnel's clean, particle-free air.

Radiation readings stayed well below global background averages, with internal gamma radiation ranging between 0.07-0.09 µSv/h and no detectable electromagnetic radiation. This continued absence of EMF supports the tunnel's reputation as an electromagnetically silent space ideal for energy-sensitive individuals and instrumentation.

Lastly, Life Energy readings were elevated at K2 (35%), Monolith egg (30%) and Water tunnel 2010 (25%), confirming earlier patterns of energetic amplification in key chambers and extended tunnel sections.

This dataset reinforces the hypothesis that winter conditions optimize the tunnel's regenerative potential, with lower external disruption allowing maximal ion accumulation and energetic equilibrium.

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Table 8: Environmental parameters measured in the Ravne tunnel complex (Summer, 6 May 2022). Weather: Cloudy; Time: 08:45; Location: Visoko, Bosnia-Herzegovina.

Location	Temp (°C)	Humidity (%)	Negative ions	Positive ions	O_2 (%)	Nuclear radiation (μSv/h)	EM radiation (mW/cm²)	Life energy (%)
Outside (front of house)	9	85	500-600	500-600	20.9	0.10	0.00	30
Outside (entrance)	9	85	1400-2000	2200-2500	20.9	0.08	0.00	20
20 m (in tunnel)	11.8	85	1500-2600	1300-3000	20.4	0.08	0.00	25
Monolith egg	13.2	85	9000-13000	11000-14000	20.4	0.07	0.00	30
K2	14.3	85	45000-48000	44000-48000	19.3	0.08	0.00	40
Tunnel no. 7	13.2	85	56000-59000	54000-55000	19.2	0.08	0.00	25
K5	13.5	85	56000-72000	60000-71000	19.2	0.07	0.00	25
Meenal Mehta tunnel	13.2	85	60000-74000	64000-72000	19.3	0.08	0.00	20
Water tunnel 2010	14.1	85	53000-55000	56000-57000	19.4	0.08	0.00	25
Orbs chamber	13.5	85	58000-63000	50000-56000	19.2	0.07	0.00	20
270 m from entrance	13.3	85	58000-67000	60000-63000	19.3	0.07	0.00	25
310 m from entrance	13.3	85	56000-66000	53000-59000	19.3	0.07	0.00	25

Interpretation of Table 8

The summer 2022 session presents a powerful continuation of the trends seen in winter, with exceptionally high ion concentrations measured in nearly all deeper tunnel chambers. Notably, Meenal Mehta Tunnel peaked at 74,000 ions/cm³, followed closely by K5 and Tunnel No. 7, reinforcing their status as energetically potent areas.

Despite being conducted in a warmer, potentially more ventilated season, negative ion values consistently surpassed 50,000 ions/cm³ in most deep locations indicating the tunnel's self-regulating air quality remains effective year-round. Ion values outside were again minimal, between 500-2000 ions/cm³, highlighting the contrast with tunnel interiors.

Oxygen levels, though slightly reduced in the deepest chambers (as low as 19.2%-19.4%), remained fully within safe physiological ranges, showing no cause for concern despite the tunnel's depth and enclosure. Meanwhile, humidity remained steady at 85%, ensuring clean, moist air that supports respiratory comfort.

All measurements of gamma radiation (0.07-0.10 μSv/h) stayed below global averages and no EM radiation was detected, making this another confirmation of the tunnel's low-radiation and EMF-free status.

Life Energy values, measured with the LM4 device, were highest in K2 (40%) and Monolith egg (30%), with stable mid-range readings elsewhere. These readings correlate closely with zones of elevated ionization and low radiation, reinforcing their classification as regenerative chambers.

This summer session demonstrates the Ravne Tunnel's ability to preserve energetic quality across seasonal conditions, highlighting its architectural and geological uniqueness.

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Table 9: Environmental parameters measured in the Ravne tunnel complex (winter, 30 December 2022). Weather: Fog; Time: 09:20; Location: Visoko, Bosnia-Herzegovina.

Location	Temp (°C)	Humidity (%)	Negative ions	Positive ions	O_2 (%)	Nuclear radiation (μSv/h)	EM radiation (mW/cm²)	Life energy (%)
Outside (front of house)	0	100	200	100	20.9	0.15	0.00	20
Outside (entrance)	2	95	300	200	20.9	0.10	0.00	25
20 m (in tunnel)	11.4	81	1800	2500	20.9	0.08	0.00	20
Monolith egg	13.0	81	32000	27000	19.5	0.08	0.00	40
K2	14.3	81	92000	87000	19.0	0.09	0.00	50
Tunnel No. 7	13.6	81	130000	126000	19.0	0.09	0.00	25
K5	14.1	81	134000	127000	19.0	0.08	0.00	20
Meenal Mehta tunnel	13.8	81	150000	146000	18.5	0.07	0.00	25
Water tunnel 2010	14.5	81	158000	160000	19.0	0.07	0.00	30
180 m from entrance	14.0	81	170000	174000	18.6	0.07	0.00	25

Interpretation of Table 9

The December 2022 winter session reveals record-setting negative ion levels across the Ravne tunnel complex, with multiple locations surpassing 100,000 ions/cm³, a rare phenomenon in global subterranean or natural environments.

The Water tunnel 2010 and Meenal Mehta tunnel both exceeded 150,000 ions/cm³, while the area 180 m from entrance reached 170,000 ions/cm³. These exceptional values reinforce the hypothesis of the tunnel's role as a naturally enriched ionization chamber.

Meanwhile, outside air measurements remained minimal (200-300 ions/cm³), emphasizing the dramatic ionization gradient between surface and subterranean locations. Despite the closed underground nature, oxygen levels remained within a safe range (18.5%-20.9%), with the lowest O_2 value (18.5%) still physiologically acceptable.

Gamma radiation levels throughout the tunnel were remarkably low (0.07-0.09 μSv/h) and EMF readings were again 0.00 mW/cm², maintaining the electromagnetically silent profile of the Ravne system.

Life energy readings, peaking at 50% in K2 and 40% in Monolith egg, maintained spatial consistency with ion-rich, low-radiation zones. The slight decrease in oxygen in some deep chambers (like Meenal Mehta) did not coincide with decreased energetic quality.

This winter 2022 dataset exemplifies the tunnel's peak regenerative conditions, particularly during cold months with minimal visitor traffic, offering insight into the self-contained energetics of this prehistoric complex.

Table 10: Environmental parameters measured in the Ravne tunnel complex (Summer, 2 June 2023). Weather: Cloudy; Time: 09:10; Location: Visoko, Bosnia-Herzegovina.

Location	Temp (°C)	Humidity (%)	Negative ions	Positive ions	O_2 (%)	Nuclear radiation (μSv/h)	EM radiation (mW/cm²)	Life energy (%)
Outside (front of house)	16.0	95	1000	700	20.9	0.09	0.00	30
Outside (entrance)	15.0	95	3000	3500	20.3	0.10	0.00	25
20 m (in tunnel)	14.7	82	5500	6000	20.2	0.09	0.00	25
Monolith egg	14.7	82	15000	16000	19.9	0.09	0.00	30
K2	15.6	82	25000	22000	19.6	0.09	0.00	40
Tunnel no. 7	14.8	82	20000	22000	19.7	0.09	0.00	20
K5	14.5	82	20000	19000	19.7	0.09	0.00	25
Meenal Mehta tunnel	14.0	82	26000	24000	19.2	0.08	0.00	20
Water tunnel 2010	14.8	82	33000	36000	19.7	0.07	0.00	25
160 m from entrance	14.1	82	26000	28000	19.8	0.07	0.00	20
Working place	13.7	82	16000	15000	19.6	0.07	0.00	20

Interpretation of Table 10:

This June 2023 summer session shows moderate to high negative ion concentrations within the Ravne Tunnel Complex, especially in deeper sections, although slightly reduced compared to winter peaks.

The Water Tunnel 2010 leads with 33,000 ions/cm^3, followed by Meenal Mehta Tunnel (26,000) and K2 (25,000). These values remain exceptionally elevated in comparison to typical outdoor environments, which registered 1,000-3,000 ions/cm^3 at the same time.

Gamma radiation remained within a low-background range (0.07-0.10 µSv/h), while electromagnetic radiation was undetectable at all tunnel locations. The oxygen concentration stayed between 19.2-20.2%, confirming safe and breathable conditions across the network.

Humidity averaged 82%, ensuring consistent microclimatic conditions beneficial for respiratory comfort and preservation of tunnel structures.

Although summer sessions typically show lower ion counts due to increased airflow from visitor activity, the data indicates the Ravne Tunnel Complex continues to function as a high-energy, low-radiation environment year-round, with minor seasonal variations.

The life energy levels, recorded between 20-40%, once again show elevation in high-ion zones, especially around K2 and Monolith egg, maintaining spatial consistency observed in previous campaigns.

Table 11: Environmental parameters measured in the Ravne tunnel complex (Winter, 11 December 2023). Weather: Fog; Time: 08:50; Location: Visoko, Bosnia-Herzegovina.

Location	Temp (°C)	Humidity (%)	Negative Ions	Positive Ions	O_2 (%)	Nuclear Radiation (µSv/h)	EM Radiation (mW/cm^2)	Life Energy (%)
Outside (front of house)	-1.0	90	300	200	20.9	0.11	0.00	20
Outside (entrance)	0.0	90	600	400	20.9	0.09	0.00	25
20 m (in tunnel)	10.3	87	8000	10000	20.4	0.07	0.00	20
Monolith egg	12.3	87	75000	71000	20.4	0.07	0.00	35
K2	14.8	87	163000	155000	19.9	0.07	0.00	35
Tunnel No. 7	13.5	87	235000	230000	19.8	0.07	0.00	30
K5	13.7	87	255000	261000	19.8	0.06	0.00	25
Meenal Mehta tunnel	13.0	87	269000	273000	19.4	0.08	0.00	20
Water tunnel 2010	14.0	87	279000	288000	19.8	0.07	0.00	30
160 m from entrance	13.6	87	290000	299000	19.8	0.06	0.00	25

Interpretation of Table 11:

This winter 2023 session revealed the highest recorded levels of negative air ions across the entire seven-year monitoring campaign. The 160 m from entrance site reached an unprecedented 290,000 ions/cm^3, while other deep tunnel locations such as Water Tunnel 2010 (279,000), Meenal Mehta Tunnel (269,000) and K5 (255,000) all reported values well above 200,000 ions/cm^3.

By contrast, outdoor air ion levels remained extremely low, ranging from 300-600 ions/cm^3, underscoring the tunnel's capacity for ion retention or generation.

Gamma radiation remained extremely low (0.06-0.08 µSv/h) inside the tunnel, indicating continued protection from ionizing radiation. Electromagnetic radiation was completely absent, preserving an EMF-free environment.

Oxygen levels remained consistently breathable (19.4%-20.4%), while humidity averaged 87%, contributing to the tunnel's balanced microclimate.

The elevated life energy readings (20%-35%) again mirrored the spatial concentration of negative ions, with peaks near K2, Tunnel no. 7 and Monolith egg. These data strongly reinforce the Ravne tunnel complex's classification as a naturally regenerative, energetically distinct underground environment especially during winter months when external influences are minimized.

Table 12: Environmental parameters measured in the Ravne tunnel complex (Winter, 25 December 2024). Weather: Cloudy; Time: 09:40; Location: Visoko, Bosnia-Herzegovina.

Location	Temp (°C)	Humidity (%)	Negative ions	Positive ions	O_2 (%)	Nuclear Radiation (µSv/h)	EM Radiation (mW/cm^2)	Life energy (%)
Outside (front of house)	0.0	93	1000	600	20.9	0.10	0.00	20
Outside (entrance)	0.0	93	1200	900	20.9	0.10	0.00	25
20 m (in tunnel)	11.0	82	1500	1100	20.9	0.09	0.00	30
Monolith egg	13.6	82	11000	12000	20.4	0.07	0.00	45
K2	14.7	82	19000	17000	20.0	0.07	0.00	45
Tunnel no. 7	13.9	82	32000	35000	19.4	0.10	0.00	25
K5	13.5	82	43000	40000	19.8	0.07	0.00	35
Meenal Mehta tunnel	13.5	82	43000	48000	19.6	0.07	0.00	25
Water tunnel 2010	14.2	82	49000	51000	20.0	0.08	0.00	30
160 m from entrance	13.5	82	52000	55000	19.7	0.08	0.00	25
Working place	13.1	82	51000	49000	19.6	0.09	0.00	25

Interpretation of Table 12

The December 2024 measurement session confirmed the continuation of high-energy conditions in the deeper sections of the Ravne Tunnel Complex. Negative air ion concentrations reached up to 52,000 ions/cm^3 at 160 m from entrance, while Water Tunnel 2010, K5 and Working Place each maintained ion values between 43,000-51,000 ions/cm^3. These values are 25-50 times higher than ambient outdoor conditions.

The Monolith Egg and K2 zones also displayed strong life energy readings (45%), reinforcing earlier patterns of energetic peaks in structurally or spiritually significant zones.

Environmental stability remained high:

- Oxygen levels between 19.6-20.9%, despite the tunnel's enclosed nature.
- Humidity held steady at 82%-93%, supporting respiratory ease and stable microclimate conditions.
- Gamma radiation remained low (0.07-0.10 µSv/h), below global natural averages.
- Electromagnetic radiation remained nonexistent throughout the tunnel network.

Taken together, the results reflect a stable, bioenergetically rich subterranean space with continued seasonal consistency in energetic and atmospheric parameters. The data further solidify the tunnel's standing as a safe, ion-rich and low-radiation environment conducive to prolonged human presence.

Table 13: Environmental parameters measured in the Ravne tunnel complex (Spring, 24 March 2025). Weather: Cloudy; Time: 10:00; Location: Visoko, Bosnia-Herzegovina.

Location	Temp (°C)	Humidity (%)	Negative ions	Positive ions	O_2 (%)	Nuclear radiation (µSv/h)	EM radiation (mW/cm^2)	Life energy (%)
Outside (front of house)	8.0	75	1100	900	20.9	0.14	0.00	20
Outside (entrance)	8.0	75	1200	900	20.9	0.10	0.00	25
20 m (in tunnel)	13.0	88	10000	17000	20.1	0.09	0.00	25
Monolith egg	13.4	88	49000	64000	19.2	0.08	0.00	45
K2	14.5	88	85000	90000	19.1	0.07	0.00	45
Tunnel no. 7	13.8	88	85000	90000	19.1	0.07	0.00	25
K5	13.5	88	110000	103000	19.8	0.07	0.00	35
Meenal Mehta tunnel	13.2	88	55000	48000	19.6	0.09	0.00	25
Water tunnel 2010	14.2	88	104000	100000	19.4	0.08	0.00	30
160 m from entrance	14.0	88	90000	80000	19.2	0.07	0.00	25
220 m from entrance	13.1	88	110000	98000	19.2	0.07	0.00	25

Interpretation of Table 13

The final dataset from March 2025 exhibits peak levels of negative air ion concentration for early spring, with values reaching 110,000 ions/cm^3 at 220 m from entrance and K5. The Water tunnel 2010, Tunnel no. 7 and K2 also maintained high levels (85,000-104,000 ions/cm^3), reinforcing their status as energetically dominant zones within the Ravne tunnel complex.

Key microclimatic parameters remain highly favorable:

- Oxygen levels ranged between 19.1%-20.9%, confirming that air quality remains breathable despite enclosed conditions.
- Humidity held at a consistent 88%, maintaining the tunnel's stable, moist atmosphere ideal for respiratory comfort.
- Gamma radiation levels remained low (0.07-0.09 µSv/h), continuing the long-term trend of minimal ionizing radiation in the tunnel.
- Electromagnetic radiation was again measured at 0.00 mW/cm^2 across all internal sites.

This spring dataset reaffirms the longitudinal energetic and environmental stability of the Ravne tunnel complex, supporting its interpretation as a uniquely preserved, bioenergetically potent subterranean space.

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Supplementary - 2

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Environmental Ionization in Enclosed Geospheres: Comparative Study of Global and Local Measurements (2018-2025)

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Supplementary 2: Measurements of NAI and PAI around the world

Table 1: Negative and positive ion concentrations in Africa. (South Africa, Zimbabwe and Ethiopia).

Location & coordinates	Date	Time	Weather	Visibility	Negative ions (ions/cm^3)	Positive ions (ions/cm^3)	Magnetic field (µT)
Great Zimbabwe Archaeological Park, Conical Granite Towers (-20.2689, 30.9333)	09-02-2020	10:30 AM	Heavy clouds, just before thunderstorm and rain	Good	1,00,000	1,00,000	19-34
Khami Ruins, Archaeological Park, west of Bulawayo (-20.1469, 28.4625)	07-02-2020	4:30 PM	Cloudy	Very good	1,200-1,800	1,200-1,800	24-39
Hotel Malaga, Waterfall Boven (-25.6343, 30.3801)	01-02-2020	2:15 PM	Sunny	Excellent	600	650	20-23
Adam's Calendar archaeological ruins, Mpumalanga (-25.9668, 30.5872)	02-02-2020	1:00 PM	Sunny, 20°C	Excellent	200	150-300	10-152
Big Stone Circle, archaeological ruins, Waterfall Boven, Mpumalanga (-25.6352, 30.3785)	01-02-2020	4:30 PM	Cloudy, warm, 28°C	Excellent	400-600	400-500	21-31
Axum, outside Stelae archaeological park (14.1304, 38.7200)	06-01-2020	11:00 AM	Sunny, warm	Very good	100-1,000	1,000-5,000	32-38
Axum, Stelae archaeological park (14.1232, 38.7156)	06-01-2020	11:15 AM	Sunny	Very good	100-3,000	200-5,000	32-40

Analysis and comparison of negative and positive ion concentrations in Africa **(Table 1)**.

The data collected from Zimbabwe, South Africa and Ethiopia reveals significant variations in negative and positive ion concentrations across different archaeological and natural sites. The measurements show how environmental conditions, altitude and natural geological formations impact air ionization.

Key observations

Exceptionally High Ionization at Great Zimbabwe (100,000 NAI & 100,000 PAI)

- The Great Zimbabwe Archaeological Park, particularly around the Conical Granite Towers, recorded the

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highest negative ion concentration in Africa (100,000 ions/cm^3).

- This extremely high level was observed just before a thunderstorm, indicating that atmospheric conditions play a crucial role in the ionization process.
- The magnetic field (19-34 µT) remained within the expected range for natural sites.

Moderate ion levels at Khami Ruins (1,200-1,800 NAI & 1,200-1,800 PAI)

- The Khami Ruins displayed moderately high ionization, with nearly equal concentrations of negative and positive ions, suggesting a balanced electrostatic environment.
- The readings were taken under cloudy conditions, which typically support a stable ionization rate.

Lower ion levels in South African sites

- Adam's Calendar (200 NAI & 150-300 PAI) and the Big Stone Circle (400-600 NAI & 400-500 PAI) recorded much lower negative ion concentrations compared to Zimbabwean sites.
- These levels, while above urban averages, indicate that South Africa's ancient stone sites may not exhibit the same electrostatic properties as their Zimbabwean counterparts.
- The magnetic field at Adam's Calendar (10 µT-152 µT) showed a wide range, hinting at possible localized geomagnetic anomalies.

Axum, Ethiopia-Variable Negative Ion Levels (100-3,000 NAI & 200-5,000 PAI)

- The two Axum sites (inside and outside Stelae Park) had a broad range of ionization, with negative ions ranging from 100 to 3,000 ions/cm^3.
- The Stelae Archaeological Park exhibited slightly higher values, possibly due to the presence of large megalithic structures influencing the ionization process.
- The magnetic field measurements (32 µT-40 µT) were the highest in this dataset, possibly indicating a link between geomagnetic intensity and air ionization.

Comparative analysis

- Great Zimbabwe clearly stands out as the most ionized location, with values significantly exceeding those recorded at other sites.
- South African sites exhibit lower ionization, likely due to their geological composition, altitude or the absence of large-scale granite structures.
- Ethiopian sites (Axum) demonstrate highly variable ion concentrations, which may be influenced by altitude, megalithic structures and localized weather conditions.
- The impact of weather is evident, as cloudy or rainy conditions (*e.g.,* Khami, Kokino) correspond to higher ion levels, while clear, sunny conditions (*e.g.,* Adam's Calendar) result in lower readings.
- Geomagnetic anomalies may contribute to ion variations, especially at Adam's Calendar, where the magnetic field showed significant fluctuations.

Conclusions

- The data suggests that ancient stone structures, geomagnetic activity and weather conditions all play a role in air ionization.
- The Great Zimbabwe site stands out as a unique high-ionization environment, possibly influenced by its large granite formations and atmospheric conditions.
- Further research is needed to determine whether the high negative ion concentrations are due to natural processes or if these ancient sites were deliberately constructed in areas with unique electrostatic properties.

Table 2: Negative and positive ion concentrations in Slovenia.

Location & coordinates	Date	Time	Weather	Visibility	Negative ions (ions/cm^3)	Positive ions (ions/cm^3)	Magnetic field (µT)
Žiri, Ravne, Slovenia (46.0436, 14.1076)	23-10-2019	12:00 PM	Sunny	Very good	1,200-1,400	800-1,400	23-49
Rakov Škocjan, Kamene Skale, Slovenia (45.7934, 14.2763)	22-10-2019	1:10 PM	Sunny, 22°C	Very good	900-1,500	1,000-1,500	45-48
Rešeto, Cerkniško jezero, Slovenia (45.7758, 14.3662)	22-10-2019	11:00 AM	Sunny	Very good	5,000	4,800	46-48
Gorica, Cerkniško jezero, Slovenia (45.7813, 14.3637)	22-10-2019	12:00 PM	Sunny	Very good	2,500	2,500	44-52
Ivarčko jezero, Ravne na Koroškem, Slovenia (46.5400, 14.9661)	20-05-2022	3:00 PM	Sunny	Excellent	400-1,000	100-400	45-58

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Analysis and Comparison of Negative and Positive Ion Concentrations in Slovenia **(Table 2)**.

The data from Slovenia provides an interesting contrast to the African sites. Slovenia's locations are primarily natural formations (lakes, caves and rock formations) rather than archaeological ruins, which allows us to explore how different landscapes, altitudes and weather conditions influence air ionization.

Key observations

Highest Ionization at Rešeto, Cerkniško Lake (5,000 NAI & 4,800 PAI)

- Rešeto at Cerkniško Lake recorded the highest concentration of negative ions (5,000 ions/cm^3), significantly surpassing other locations in Slovenia.
- The high levels suggest that water bodies, karst formations and air movement over the lake contribute to increased ionization.
- This pattern is consistent with studies showing that lakes, waterfalls and underground rivers enhance negative ion production.

Gorica, Cerkniško Lake-elevated ionization (2,500 NAI & 2,500 PAI)

- Located near Rešeto, Gorica also exhibits high ion levels, reinforcing the idea that Cerkniško Lake's environment plays a key role in ion production.
- The balance of negative and positive ions suggests a stable electrostatic environment.

Rakov Škocjan and Žiri, Ravne-moderate ion levels (900-1,500 NAI & 1,000-1,500 PAI)

- Both sites are rocky landscapes with limestone formations.
- The negative ion levels are significantly higher than urban environments, but lower than those recorded at Cerkniško Lake.
- The readings confirm that natural rock formations contribute to negative ion generation, though not as much as large bodies of water.

Lowest Ionization at Ivarčko Lake (400-1,000 NAI & 100-400 PAI)

- The lowest recorded values in Slovenia were at Ivarčko Lake, where negative ion levels were below 1,000 ions/cm^3.
- This site had the largest imbalance between negative and positive ions, suggesting a less stable air ion environment.
- While lakes generally contribute to ion production, the absence of waterfalls, underground water sources or strong air currents may explain the lower levels.

Comparative analysis

- Cerkniško Lake (Rešeto & Gorica) is the most ionized site in Slovenia, likely due to karstic geology, water movement and underground air currents.
- Rakov Škocjan and Žiri show moderate ionization, which aligns with expectations for rocky terrains and cave-like environments.
- Ivarčko Lake has the lowest ion levels, indicating that not all water bodies produce high negative ion concentrations.

Conclusions

- Water-related environments, especially in karstic regions, significantly boost negative ion concentrations.
- Limestone caves and rocky formations contribute to ionization, but to a lesser extent than lakes and underground rivers.
- The role of underground air currents and microclimates should be further examined to determine their influence on air ion levels in natural environments.
- Compared to African sites, Slovenia's measurements are lower overall, reinforcing the idea that granite formations (like in Great Zimbabwe) and geomagnetic anomalies may also be crucial factors in high ionization levels.

Table 3: Negative and positive ion concentrations in Macedonia.

Location & coordinates	Date	Time	Weather	Visibility	Negative ions (ions/cm^3)	Positive ions (ions/cm^3)	Magnetic field (μT)
Kale Fortress, Archaeological Site, Skopje (41.9992, 21.4291)	13-05-2023	11:00 AM	Cloudy	Good	300	300	-
Kokino Ancient Astronomical Observatory, Kumanovo (42.2603, 21.9522)	20-05-2021	1:30 PM	Cloudy/rain	Good	300-400	10-50	49-50
Cocev Kamen, Ancient Astronomical Observatory,	21-05-2021	12:00 PM	Cloudy	Good	300-1,000	160-300	47-49

Šopsko Rudare (42.1370, 21.9527)							
Kanda Geoglyph, Archaeological Site, Sveti Nikole (41.8519, 21.9064)	22-05-2021	2:00 PM	Sunny	Excellent	500-1,000	300	43-57
Ostrovica, Archaeological Site, Sveti Nikole (41.8850, 21.8598)	23-05-2021	3:00 PM	Sunny	Excellent	300-500	300-500	34-40

Analysis and comparison of negative and positive ion concentrations in Macedonia **(Table 3)**.

The measurements from Macedonia were taken at archaeological sites, ancient astronomical observatories and geoglyph locations, providing insight into how ancient structures and natural environments influence air ionization.

Key observations

Highest Ionization at Kanda Geoglyph (500-1,000 NAI & 300 PAI)

- The Kanda Geoglyph site recorded the highest negative ion levels in Macedonia (up to 1,000 ions/cm^3).
- This site is an enigmatic, large-scale earth formation, potentially interacting with atmospheric or geomagnetic forces to create increased ionization.
- Sunny conditions and excellent visibility further support high ion production.

Cocev Kamen-Wide Ion Range (300-1,000 NAI & 160-300 PAI)

- Cocev Kamen is an ancient astronomical observatory, associated with ritual activities and possibly aligned with cosmic events.
- The significant range in negative ions suggests that localized air circulation and surface properties (*e.g.,* rock composition) may influence readings.

Moderate Ionization at Kokino Observatory (300-400 NAI & 10-50 PAI)

- Kokino, another ancient astronomical site, exhibited lower negative ion concentrations than expected.
- The presence of rainy/cloudy weather during the measurement could have affected air ion dynamics.
- Notably low positive ion levels (10-50 PAI) suggest a potential electrostatic imbalance, possibly influenced by geological features.

Kale Fortress-Lowest Ionization (300 NAI & 300 PAI)

- The Kale Fortress in Skopje had the lowest recorded negative ion concentration, at just 300 ions/cm^3, similar to urban outdoor environments.
- The presence of a man-made structure, potentially with reduced air flow and higher human activity, might explain the lower ionization levels.

Ostrovica-balanced ionization (300-500 NAI & 300-500 PAI)

- Ostrovica, another archaeological site, had fairly stable negative and positive ion concentrations.
- This balance suggests a natural electrostatic equilibrium, though ion levels remain on the lower end compared to other sites in Macedonia.

Comparative analysis

- Kanda Geoglyph shows the highest ionization, possibly due to natural geological factors or its interaction with atmospheric currents.
- Ancient observatories (Cocev Kamen, Kokino) have moderate ionization, suggesting a possible relationship between negative ion production and elevated terrains or ritual sites.
- Urban or modified environments (Kale Fortress) exhibit the lowest ion levels, reinforcing the idea that man-made structures can suppress natural ionization processes.
- Geomagnetic anomalies at some sites (*e.g.,* Kokino at 49-50 µT) might be influencing ion concentrations, though more research is needed to establish a direct link.

Conclusions

- Negative ion concentrations in Macedonia are generally lower than in Slovenia and Africa, suggesting that geology, altitude and human activity influence ion production.
- Astronomical observatories and ritual sites exhibit moderate ionization, which may be related to elevated locations, exposure to wind currents or the natural composition of the stones.
- The Kanda Geoglyph stands out as an exception, potentially indicating that certain geomagnetic or atmospheric factors contribute to increased ionization.
- The impact of weather is evident, as cloudy and rainy conditions at Kokino correspond to lower negative ion levels.

Table 4: Negative and positive ion concentrations in Italy.

Location	Date	Time	Weather	Visibility	Negative ions (ions/cm^3)	Positive ions (ions/cm^3)	Magnetic field (μT)
Taino, hotel 'Bob Room' (45.7485° N, 8.6134° E)	20-10-2019	8:53 AM	Rain, 24°C	Poor	Oct-40	80-400	44-49
Sardinia, Menhir at Villa Sant Antonio archaeological site (39.9042° N, 8.8213° E)	15-11-2019	3:00 PM	Cloudy, windy, 12°C	Very good	1.200-2.200	200-500	44-52
Vuccuru Nuraxi archaeological site, Settimo San Pietro, Sardinia (39.2586° N, 9.1897° E)	15-11-2019	11:15 AM	Cloudy, 12°C	Good	600	700	36-50
Pauli Arbarei, archaeological site with destroyed stone pyramid, Sardinia (39.6713° N, 8.9132° E)	14-11-2019	11:00 AM	Sunny	Very good	1.2	1.500-2.500	43-45
Sadhu e Sorcu, 'Giants Tomb' archaeological site, central Sardinia (40.1147° N, 9.0924° E)	13-11-2019	2:40 PM	Cloudy, 12°C	Good	2.000-3.500	2.000-3.500	42-52
Nuraghe Losa of Abbasanta, central Sardinia (40.1664° N, 8.7512° E)	11-11-2019	1:40 PM	Partly cloudy, 15°C	Very good	3	2	36-46
Santa Christina, Sacred Well archaeological site, Pauli Latino, central Sardinia (40.0162° N, 8.7367° E)	11-11-2019	10:55 AM	Partly cloudy, 14°C	Very good	2	2	41-53
La Prisgiona, Nuraghe archaeological site, conical granite tower, Arzachena, Sardinia (41.1014° N, 9.4006° E)	10-11-2019	12:40 PM	Cloudy, 14°C	Good	2.000-6.000	1.300-3.500	46-51
Giants' Tomb, Tomba di Giganti, archaeological site, Arzachena, Sardinia (41.0942° N, 9.4236° E)	10-11-2019	11:10 AM	Cloudy, 14°C	Very good	1.000-2.000	1.000-1.800	44-52
Monte D'Accodi, Zigurat-Pyramid archaeological site, Sassari Province, Sardinia (40.7893° N, 8.5019° E)	09-11-2019	2:45 PM	Cloudy, 18°C	Good	800-1.200	200-900	41-45
Monte D'Accodi, altar in front of the Pyramid, Sassari Province, Sardinia (40.7893° N, 8.5019° E)	09-11-2019	3:30 PM	Cloudy, 18°C	Good	500	500	45-52
Damanhur, Circle of Rituals (45.3956° N, 7.7211° E)	20-10-2019	3:21 PM	Rain, 16°C	Fair	1.500-2.600	1.000-1.500	42-52
Varese, Sesto Calende, Stone Preja Buja (45.7363° N, 8.6337° E)	21-10-2019	10:26 AM	Rain, 19°C	Fair	1	1	46-54
Mongrando Pyramid, Biella, Varese (45.5526° N, 8.0044° E)	20-10-2019	12:00 PM	Rain, 17°C	Low	1.500-2.000	800	42-52

Overview & trends

Diverse measurement sites

- The locations in Italy include megalithic sites, pyramidal structures, sacred wells and ritual circles, mostly in Sardinia but also in Lombardy and Piedmont.
- Different geological and environmental settings provide a range of ion concentrations.

Negative ion concentrations

- The lowest negative ion readings were observed in Taino, Hotel 'Bob Room' (10-40 NAI/cm^3) during rain and poor visibility.
- The highest values were recorded at La Prisgiona Nuraghe (2,000-6,000 NAI/cm^3) and Sadhu e Sorcu, 'Giants' Tomb' (2,000-3,500 NAI/cm^3).
- Monte d'Accoddi, the Pyramid-Ziggurat site, had

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relatively low values (800-1,200 NAI/cm^3), while its altar had even lower concentrations (500 NAI/cm^3).

Positive ion concentrations

- Positive ion concentrations often mirror negative ions, showing similar trends.
- The highest PAI values were 1,500-2,500 PAI/cm^3 at Pauli Arbarei (stone pyramid site) and 2,000-3,500 PAI/cm^3 at La Prisgiona Nuraghe.

Magnetic Field Variations:

- The strongest magnetic fields were recorded at Varese, Sesto Calende (46-54 µT) and Pauli Arbarei (43-45 µT).
- Other locations range between 36-53 µT, showing moderate but consistent variations.

Comparative analysis

- Compared to Africa, where some locations reached 100,000 NAI/cm^3 (Great Zimbabwe), the Italian sites have significantly lower negative ion values.
- Bosnian Pyramid tunnels still show the highest readings worldwide (20,000-340,000 NAI/cm^3).
- Italy's megalithic sites, especially La Prisgiona Nuraghe, Sacred Well Santa Christina and Giants' Tombs, show elevated negative ion levels, potentially due to underground water flow, geomagnetic activity and natural ionization processes.

Key findings & hypothesis

- Ancient sacred sites and nuraghe structures tend to have higher ion concentrations than non-archaeological locations (*e.g.,* Taino Hotel).
- Rainy weather and poor visibility significantly reduce ion concentration, as seen in Taino, Mongrando Pyramid and Damanhur.
- The presence of stone structures, particularly granite towers, pyramidal formations and sacred wells, correlates with higher NAI values.
- The geomagnetic field variations suggest that some sites may have underground energy influences or natural piezoelectric effects.

Table 5: Negative and positive ion concentrations in the United Kingdom and Germany.

Location	Date	Time	Weather	Visibility	Negative ions (ions/cm^3)	Positive ions (ions/cm^3)	Magnetic field (µT)
Avebury Sanctuary, archaeological site, England (51.4284° N, 1.8522° W)	15-09-2022	10:10 AM	Cloudy	Good	1,000	1,000	49-51
Silbury Hill, tumulus archaeological site, England (51.4287° N, 1.8496° W)	15-09-2022	11:30 AM	Cloudy	Good	400	200	49-51
Zuschen Fritzlar, Megalithic archaeological site, Hesse, Germany (51.1544° N, 9.3812° E)	06-03-2020	1:00 PM	Cloudy/Rainy	Good	500-800	250-500	38-61

Analysis

Overview

- The archaeological sites in the United Kingdom (Avebury Sanctuary and Silbury Hill) and Germany (Zuschen Fritzlar) exhibit moderate to low negative and positive ion concentrations.
- Avebury Sanctuary and Sillbury Hill, both located in England represent prehistoric, megalithic monuments of significant historical and spiritual importance.
- Zuschen Fritzlar is also a megalithic site, but its ion concentrations seem somewhat more variable compared to the UK sites.

Negative Ions (NAI)

- The Avebury Sanctuary shows the highest negative ion concentration at 1,000 NAI/cm^3.
- Silbury Hill, a tumulus, shows lower values, 400 NAI/cm^3, possibly due to its different structure compared to the larger stone circles at Avebury.
- The Zuschen Fritzlar site in Germany ranges from 500 to 800 NAI/cm^3, indicating that megalithic sites in the region may have slightly higher ion concentrations than tumulus sites, but still lower compared to sites like the Bosnian Pyramids or certain African locations.

Positive Ions (PAI)

- Positive ion values in the UK sites are fairly balanced with the negative ions, 1,000 PAI/cm^3 at Avebury and 200 PAI/cm^3 at Silbury Hill.
- Zuschen Fritzlar shows a higher range for positive ions, ranging from 250 to 500 PAI/cm^3, which may reflect the different atmospheric conditions (cloudy/rainy) affecting ionization.

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Magnetic field

- The magnetic field measurements show consistent readings in the 49-51 µT range for the UK sites, which suggests stable geomagnetic conditions in these regions.
- Zuschen Fritzlar in Germany has a wider range of magnetic fields (38-61 µT), which might be due to the local geological structure and weather variations.

Comparison

- Avebury Sanctuary has the highest ion concentrations of this group, with 1,000 NAI/cm^3 and an equal number of positive ions.
- The Zuschen Fritzlar site, though higher in variability, has similar ion concentration values but exhibits wider magnetic field fluctuations, which could suggest the presence of local energy fields.
- Silbury Hill, as a tumulus, tends to have the lowest ion readings, possibly due to the structure and the surrounding environment.
- Compared to Italy and Africa, the ion concentrations in these UK and German sites are significantly lower. Sites like La Prisgiona Nuraghe in Sardinia and Great Zimbabwe in Africa exhibit much higher negative ion concentrations, likely due to geological and environmental factors, as well as the natural energy phenomena of those locations.

Conclusions

- Megalithic sites in the UK and Germany (Avebury, Silbury Hill, Zuschen Fritzlar) show moderate ion concentrations compared to pyramids and tumulus structures in other regions.
- The presence of ancient stone structures and their relation to geomagnetic fields can be speculated to influence ionization, but in this case, it seems the highest concentrations are still found in Bosnian and African archaeological sites.
- Further research could explore why magnetic field variations in sites like Zuschen Fritzlar might affect ion concentrations or if seasonal weather patterns play a role in ionization at these sites.

Table 6: Negative and positive ion concentrations in the United States.

Location	Date	Time	Weather	Visibility	Negative ions (ions/cm^3)	Positive ions (ions/cm^3)	Magnetic field (µT)
Red Rock Canyon, Turtleneck trail, Las Vegas, Nevada, USA (36.1130° N, 115.4410° W)	07-10-2022	10:30 AM	Sunny	Excellent	600-900	200	42-48
Yellowstone Park, Porcelain Basin, Wyoming, USA (44.5292° N, 110.6992° W)	11-10-2022	12:00 PM	Cloudy	Good	700-1,000	400-1,000	53-56
Sage Wall, archaeological site, Butte, Montana, USA (46.0330° N, 112.5390° W)	12-10-2022	12:00 PM	Sunny	Excellent	400-600	300-1,000	49-55
Tizer Dolmen, archaeological site, near Jefferson City, Montana, USA (46.5746° N, 112.0950° W)	13-10-2022	11:55 AM	Sunny	Clear	50-900	30-1,400	51-56

Analysis

Overview

- The USA sites (Red Rock Canyon, Yellowstone Park, Sage Wall and Tizer Dolmen) show a range of negative and positive ion concentrations, with notable variations between the locations. The weather conditions and visibility are also factors that might affect ionization levels.
- These sites are spread across diverse regions of the USA, from Nevada to Wyoming and Montana, showcasing both arid and more temperate environments.

Negative Ions (NAI)

- Red Rock Canyon shows a moderate range of 600-900 NAI/cm^3, likely due to the dry, desert-like conditions of Nevada.
- Yellowstone Park in Wyoming has a higher range of 700-1,000 NAI/cm^3, suggesting that the natural geothermal activity in the park, combined with its

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cloudy weather, likely influences the ion concentration.

- Sage Wall, Montana, shows moderate concentrations of 400-600 NAI/cm^3, which seems consistent with other archaeological sites in areas with clear visibility and sunny conditions.
- Tizer Dolmen presents a wide range of 50-900 NAI/cm^3, with the potential for fluctuations due to local geological features and weather conditions.

Positive Ions (PAI)

- Red Rock Canyon has a relatively low 200 PAI/cm^3, which is expected in a dry desert environment with excellent visibility.
- Yellowstone Park shows a range from 400-1,000 PAI/cm^3, which is relatively high and might be influenced by the geothermal energy in the park, along with the cloudy weather.
- Sage Wall displays a wider range of 300-1,000 PAI/cm^3, reflecting the variation in atmospheric conditions and the location's potential to hold higher positive ion concentrations.
- Tizer Dolmen shows significant variation with values ranging from 30-1,400 PAI/cm^3, possibly due to local energy fields and weather fluctuations that influence the ionization process.

Magnetic field

- The magnetic fields in the USA sites range from 42 µT (Red Rock Canyon) to 56 µT (Tizer Dolmen), which is similar to many of the European and African sites. This suggests that the USA archaeological sites are located in areas with stable geomagnetic conditions, with slight variations due to local geological factors.

Comparison

- Yellowstone Park and Tizer Dolmen exhibit higher ion concentrations than Red Rock Canyon and Sage Wall, likely due to geothermal activity and the geological nature of the sites.
- The Sage Wall site, while in a sunny location, shows moderate ion concentrations (400-600 NAI and 300-1,000 PAI), which is typical for archaeological sites with clear visibility.
- The ion concentrations in these USA sites are lower than those observed in Bosnian and African locations, but similar to those found in European sites such as Italy and Germany.

Conclusions

- The USA archaeological sites show moderate to high negative ion concentrations, especially in places like Yellowstone Park and Tizer Dolmen.
- The variation in positive ion concentrations across these sites can be linked to local geological activity (*e.g.,* geothermal activity in Yellowstone), weather conditions and natural energy fields present in the area.
- As with European sites, these results further emphasize the importance of environmental conditions in shaping ion concentrations at archaeological locations.

Table 7: Negative and positive ion concentrations in Croatia.

Location	Date	Time	Weather	Visibility	Negative ions (ions/cm^3)	Positive ions (ions/cm^3)	Magnetic field (µT)
Parking hotel 'Amarin', Rovinj, Croatia (45.0892° N, 13.6400° E)	28-09-2022	8:30 AM	Cloudy	Good	1,100	1,200	20-48
Picugi archaeological site, Poreč, Istra, Croatia (45.2215° N, 13.6385° E)	28-09-2022	10:00 AM	Cloudy	Good	500-1,300	500-1,300	44-48
Mamjan, Istra, Croatia (45.3782° N, 13.6419° E)	28-09-2022	7:00 PM	Rain	Good	400-700	800	46-50
Motovun, St. Stephen Church, Istra, Croatia (45.3362° N, 13.8289° E)	28-09-2022	4:00 PM	Cloudy	Good	1,000-1,700	900-1,300	41-49
Sveta Foška, Church, Pula, Istra, Croatia (44.9481° N, 13.8694° E)	30-09-2022	3:00 PM	Rain	Good	2,100	2,100	43-47
Island Pag, megalithic wall, Croatia (44.4461° N, 14.9822° E)	24-03-2023	11:45 AM	Sunny	Excellent	600-700	800-1,000	-
Obrovac, double megalith archaeological site, Croatia (44.1898° N, 15.6834° E)	25-03-2023	12:00 PM	Cloudy	Good	600	600	121-124
Asseria megalithic walls archaeological site, Podgrađe, Zadar, Croatia (44.1621° N, 15.6354° E)	25-03-2023	10:00 AM	Cloudy	Good	100-200	90	-

Analysis

Overview

- The Croatian sites represent a mix of archaeological locations, sacred sites and natural formations across Istria, Zadar and the island of Pag.
- Weather conditions varied, with cloudy and rainy days predominating, but some sites were recorded under sunny conditions.
- The negative ion concentrations vary significantly, from as low as 100-200 NAI/cm^3 at Asseria Megalithic Walls to as high as 2,100 NAI/cm^3 at Sveta Foška Church.

Negative Ions (NAI)

- Sveta Foška Church (2,100 NAI) recorded the highest negative ion concentration, which might be attributed to its historical significance, spiritual energy or natural ionization sources.
- Motovun (St. Stephen Church) and Picugi archaeological site also showed elevated levels (1,000-1,700 NAI), suggesting potential geomagnetic or earth-energy influences.
- Mamjan and Pag Megalithic Wall had moderate levels of 400-700 NAI, aligning with typical outdoor natural environments.
- Asseria Megalithic Walls had the lowest recorded negative ions (100-200 NAI), possibly due to lower vegetation density or weaker geological ionization sources.

Positive Ions (PAI)

- Sveta Foška Church also had the highest positive ion concentration (2,100 PAI), aligning with its high negative ion levels.
- Motovun (900-1,300 PAI) and Picugi archaeological site (500-1,300 PAI) had notable positive ion concentrations, mirroring their negative ion levels.
- Asseria showed the lowest PAI (90/cm^3), indicating an extremely weak ionization environment.

Magnetic field

- The highest magnetic field strength was recorded at Obrovac (121-124 µT), significantly above Earth's average (40-50 µT), suggesting potential geomagnetic anomalies.
- Most other sites ranged between 41-50 µT, consistent with natural background levels.

Comparison with other regions

- The high ionization levels at Sveta Foška Church (2,100 NAI & 2,100 PAI) resemble values found in Damanhur (Italy) and some Bosnian Pyramid tunnels, reinforcing the idea that sacred sites may have distinct energy properties.
- The moderate ion levels of Motovun, Pag and Picugi align with many European megalithic sites such as those in Germany and the UK.
- Obrovac's unusually high magnetic field (121-124 µT) stands out compared to other regions, which typically show values between 40-60 µT.

Conclusions

- Sacred sites like Sveta Foška and Motovun have significantly higher ion levels, suggesting potential energetic properties.
- Megalithic locations like Pag Megalithic Wall and Picugi show moderate ionization, comparable to sites in Germany, Italy and Macedonia.
- Obrovac's high magnetic field anomaly may indicate an unusual geological feature worth further investigation.

Table 8: Negative and positive ion concentrations in Serbia.

Location	Date	Time	Weather	Visibility	Negative ions (ions/cm^3)	Positive ions (ions/cm^3)	Magnetic field (µT)
Lepenski Vir, major archaeological site, Serbia (44.5775° N, 21.7042° E)	21-10-2020	3:00 PM	Sunny	Excellent	100-800	100-500	48-50
Vinča, major archaeological site, Belgrade, Serbia (44.7483° N, 20.6672° E)	22-10-2020	3:00 PM	Sunny	Excellent	200-400	200-400	45-51
Drenajić energy circles, natural energetic site, Valjevo, Serbia (44.2726° N, 19.8820° E)	23-10-2020	3:30 PM	Sunny	Good	300-500	400-600	47
Ritopek, Glavica, 'Pyramid' hill, Belgrade, Serbia (44.7202° N, 20.6131° E)	17-03-2021	1:00 PM	Cloudy/ice rain, 8°C	Good	200-800	600-900	39-78

Mala Krsna, energy site 'Najdanov krug', Požarevac, Serbia (44.6279° N, 20.9565° E)	17-03-2021	3:00 PM	Cloudy	Good	800	300-500	-
Vatin, archaeological site 'Vršački krugovi' (Vršac circles), Serbia (45.1512° N, 21.3005° E)	22-04-2021	6:45 PM	Sunny	Excellent	500	300	47-49
Kuršumlija, entrance to the Middle Age fort, Serbia (43.1402° N, 21.2771° E)	19-05-2021	6:15 PM	Cloudy & Windy	Good	100-600	100-400	48-50
Village Rudare, Branko's tower archaeological site, Kuršumlija, Serbia (43.1453° N, 21.2679° E)	19-05-2021	6:20 PM	Cloudy	Good	100-400	200-800	49-50
Village Gornji Taor stone sphere archaeological site, Kukalj hill, Valjevo, Serbia (44.1442° N, 19.8823° E)	17-04-2022	2:10 PM	Cloudy, 10°C	Good	300	100	44-54
Village Gornji Taor stone sphere archaeological site, Kukalj hill, Valjevo, Serbia (44.1442° N, 19.8823° E)	17-04-2022	2:10 PM	Cloudy, 10°C	Good	300	100	44-54
Povlen, stone sphere archaeological site, Belevode, village Gornji Taor Valjevo, Serbia (44.1346° N, 19.7850° E)	17-04-2022	3:45 PM	Cloudy, 9°C	Good	300	300	38-49
Tumulus Jurišina kosa, archaeological site, Žabalj, Bačka, Vojvodina, Serbia (45.3471° N, 20.0508° E)	15-04-2022	12:00 PM	Cloudy	Good	200	200	46-49
Banoštor energy site 'Sofijini izvori (circles)', Fruška gora, Serbia (45.1949° N, 19.6183° E)	19-04-2022	10:00 AM	Cloudy	Good	300	700	45-51
'Novak' tennis complex, Belgrade, Serbia (44.8176° N, 20.4383° E)	20-10-2020	11:30 AM	Sunny	Excellent	200-400	200-400	46-48

Analysis

Overview

- The Serbian locations include prehistoric sites (Lepenski Vir, Vinča), energetic sites (Drenajić, Najdanov Krug, Sofijini izvori), pyramid-like hills (Ritopek-Glavica) and megalithic formations (Povlen, Kukalj Hill, Vršački krugovi).
- Weather was mostly cloudy or sunny, except for Ritopek (ice rain, 8°C).
- Negative ion levels range widely, from 100 to 800 NAI/cm^3, while positive ions range from 100 to 900 PAI/cm^3.
- Magnetic fields vary between 38-78 µT, with Ritopek recording an exceptionally high 78 µT.

Negative Ions (NAI)

- Mala Krsna (Najdanov Krug) had the highest NAI (800/cm^3), suggesting strong energetic activity.
- Lepenski Vir (100-800 NAI), one of the oldest European settlements, had fluctuating values, possibly affected by the Danube River.
- Ritopek (200-800 NAI) and Vinča (200-400 NAI) suggest moderate energetic properties.
- Stone sphere sites (Povlen, Kukalj Hill) had consistent but lower values (~300 NAI).

Positive Ions (PAI)

- Ritopek recorded the highest PAI (600-900/cm^3), indicating a possible geomagnetic anomaly.
- Sofijini izvori had an unusually high positive ion concentration (700/cm^3).
- Most sites maintained a balanced NAI/PAI ratio, except for Rudare, where PAI exceeded NAI (200-800 ***vs.*** 100-400).

Magnetic field analysis

- Ritopek-Glavica recorded an unusually high 78 µT, significantly above Earth's natural background (~50 µT), indicating possible underground magnetic anomalies.
- Most other sites ranged between 38-54 µT, which is within normal variation.

Comparison with other countries

- Serbian megalithic and archaeological sites show moderate to high ionization, similar to those in Croatia, Bosnia and Germany.
- Mala Krsna (Najdanov Krug) had higher ion levels than

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Italy’s Damanhur but lower than Bosnia’s Ravne tunnels.

- Ritopek's magnetic field anomaly (78 µT) is one of the highest recorded and aligns with energy anomalies found in places like Obrovac (Croatia) and some Egyptian sites.

Conclusions

- Energetic sites like Mala Krsna, Ritopek and Sofijini izvori exhibit strong ionization activity, suggesting potential telluric energy influences.
- Prehistoric settlements (Lepenski Vir, Vinča) show moderate ion levels, indicating an optimal location selection by ancient civilizations.
- Ritopek’s high magnetic anomaly (78 µT) warrants further investigation, as it might correlate with its pyramid-like shape.
- Serbia’s stone spheres (Povlen, Kukalj Hill) have moderate ionization, aligning with megalithic sites in the Balkans and Central Europe.

Table 9: Negative and positive ion concentrations in Bosnia-Herzegovina.

Location	Date	Time	Weather	Visibility	Negative ions (ions/cm^3)	Positive ions (ions/cm^3)	Magnetic field (µT)
Village Štrepci, Cyclopean walls archaeological site, Brčko, Bosnia-Herzegovina (44.8622° N, 18.6594° E)	08-05-2023	2:00 PM	Cloudy	Good	300-400	200-400	107-109
Village Bistro, megalithic site with 'stećak' blocks, Novi Travnik, Bosnia-Herzegovina (44.1712° N, 17.6469° E)	29-05-2020	10:30 AM	Cloudy	Good	700	500	47-49
Village Zagrilje, megalithic site with 'stećak' blocks, Kaurlaš necropolis, Novi Travnik, Bosnia-Herzegovina (44.1829° N, 17.6432° E)	28-05-2020	11:30 AM	Cloudy	Good	400	300	45-46
Village Maculje, megalithic site with 'stećak' blocks, Novi Travnik, Bosnia-Herzegovina (44.1663° N, 17.6290° E)	28-05-2020	-	Cloudy/Rain	Good	350	250	47-55
Kaštela Fortress, archaeological site, Kiseljak, Bosnia-Herzegovina (43.9434° N, 18.0775° E)	29-05-2021	11:00 AM	Sunny	Excellent	800-1,200	1,000-1,500	51-53
Archaeological site 'Detlačke ambarine', Derventa, Bosnia-Herzegovina (44.9765° N, 17.9021° E)	05-04-2023	2:45 PM	Cloudy	Good	800	900	144-178
Igman Mountain, Hadžići, Sarajevo, Bosnia-Herzegovina (43.7172° N, 18.2701° E)	02-01-2022	11:30 AM	Cloudy and cold	-	750	750	-
Bjelašnica Mountain, Hadžići, Sarajevo, Bosnia-Herzegovina (43.7064° N, 18.2567° E)	02-01-2022	12:30 PM	Cloudy and cold	-	950	900	-
Jahorina Mountain, Pale, Bosnia-Herzegovina (43.7306° N, 18.5692° E)	02-01-2022	3:30 PM	Cloudy and cold	-	1,000	950	-

Analysis of negative and positive ion concentrations in Bosnia-Herzegovina

General Trends in Negative Ions (NAI) and Positive Ions (PAI)

- Negative ion levels in Bosnia-Herzegovina vary between 300 and 1,200 NAI/cm^3, with archaeological and mountain locations showing the highest values.
- Positive ions tend to remain in a similar range, usually between 200 and 1,500 PAI/cm^3.
- The highest ion concentrations are observed in mountainous regions and well-preserved archaeological sites.

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Archaeological sites *vs.* natural mountain sites

Archaeological sites

- Kaštela Fortress (800-1,200 NAI/cm^3) and Detlačke ambarine (800 NAI/cm^3) show some of the highest negative ion concentrations among archaeological sites.
- Village Bistro (700 NAI/cm^3) also stands out with a high negative ion count.
- Cyclopean walls of Štrepci recorded only 300-400 NAI/cm^3, making it one of the lower negative ion readings.

Natural mountain sites

- Igman Mountain: 750 NAI/cm^3
- Bjelašnica Mountain: 950 NAI/cm^3
- Jahorina Mountain: 1,000 NAI/cm^3.
- These values confirm the well-known effect of high-altitude environments in generating large amounts of negative ions, supporting overall well-being and air purification.

Comparison of mountains and archaeological sites

Type	Average negative ions (NAI/cm^3)	Highest recorded NAI
Mountain sites	750-1,000	1,000 (Jahorina)
Archaeological sites	300-1,200	1,200 (Kaštela Fortress)

- Jahorina Mountain (1,000 NAI/cm^3) has a higher ion count than most archaeological sites, except Kaštela Fortress.
- This confirms that mountain air tends to be more ionized, likely due to altitude, lower pollution and natural air movement.

Unique findings

- Kaštela Fortress and Jahorina Mountain had the highest negative ion concentrations.
- Cyclopean walls at Štrepci showed the lowest values (300-400 NAI/cm^3) among archaeological sites.
- The Derventa site (Detlačke ambarine) had an exceptionally high magnetic field reading (144-178 μT), possibly linked to unique underground structures or geomagnetic anomalies.

Conclusion

- Bosnia-Herzegovina offers a mix of highly ionized sites, both natural and archaeological.
- Jahorina Mountain (1,000 NAI/cm^3) and Kaštela Fortress (1,200 NAI/cm^3) emerge as the most energetic sites in this study.
- Magnetic anomalies in Derventa should be further explored for possible energetic or archaeological significance.
- This data aligns with global studies on negative ion benefits, reinforcing the healing potential of both historical and natural locations in Bosnia-Herzegovina.

Table 10: Negative and positive ion concentrations in Bosnian Pyramid underground Tunnels, Visoko.

Location	Date	Time	Temperature (°C)	Humidity (%)	Negative ions (ions/cm^3)	Positive ions (ions/cm^3)
Outside (in front of the house)	01.07.2024	9:10 AM	20	68	1,000	700
Outside (entrance to tunnels)	01.07.2024	9:10 AM	20	68	7,000	6,500
20m inside the tunnel	01.07.2024	9:10 AM	15	70	3,500	4,000
Monolith egg	01.07.2024	9:10 AM	14.6	74	36,000	38,000
K2	01.07.2024	9:10 AM	15.1	74	40,000	43,000
Tunnel No.7	01.07.2024	9:10 AM	14.8	74	40,000	42,000
K5	01.07.2024	9:10 AM	14.5	74	43,000	40,000
Meenal Mehta Tunnel	01.07.2024	9:10 AM	14.3	74	50,000	54,000
Water Tunnel 2010	01.07.2024	9:10 AM	15	74	48,000	44,000
160m from entrance	01.07.2024	9:10 AM	14.8	74	48,000	44,000

Analysis of negative and positive ion concentrations in Bosnian Pyramid underground tunnels

Negative ion concentration levels

- The negative ion concentration increases dramatically as one moves deeper into the tunnels.
- Outdoor air in front of the house (1,000 NAI/cm^3) is within the expected range for a natural outdoor

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environment.

- At the tunnel entrance (7,000 NAI/cm^3), negative ions increase 7x compared to open-air conditions.
- Inside the tunnels, values rise sharply, peaking at 50,000 NAI/cm^3 in Meenal Mehta Tunnel.
- The Water Tunnel 2010 and 160m point (48,000 NAI/cm^3) show consistently high ion counts, suggesting a stable underground energy field.

Positive ion concentration levels

- Unlike most natural environments where negative ions outnumber positive ions, some tunnel areas have an unusually high presence of positive ions.
- Meenal Mehta Tunnel (54,000 PAI/cm^3) has the highest positive ion count, slightly exceeding its negative ion concentration.
- The K2 and Tunnel No.7 areas also have high positive ion values (42,000-43,000 PAI/cm^3).
- This imbalance may indicate unique underground electrostatic interactions, possibly linked to mineral compositions or subterranean water flows.

Effect of depth on ion concentrations

Depth	Negative ions (NAI/cm^3)	Positive ions (PAI/cm^3)
Entrance (0m)	7,000	6,500
20m inside	3,500	4,000
Monolith egg	36,000	38,000
K2	40,000	43,000
K5	43,000	40,000
Meenal Mehta tunnel	50,000	54,000
160m inside	48,000	44,000

- The deeper the measurement point, the higher the negative ion concentration.
- A major ionization jump occurs between 20m inside (3,500 NAI/cm^3) and Monolith Egg (36,000 NAI/cm^3).
- Values remain consistently high beyond 100m depth, indicating a stable underground energetic field.

Temperature and humidity stability

- Despite moving deeper underground, temperature remains between 14.3-15.1°C, suggesting a well-insulated subterranean climate.
- Humidity remains at ~74% in all deeper tunnel areas, reinforcing the stable underground microclimate.
- The stable humidity may play a role in preserving negative ion concentrations.

Comparison to other locations

Location	Negative ions (NAI/cm^3)
Open-air in front of house	1,000
Mountain air (Jahorina, Bjelašnica)	1,000
Kaštela Fortress (Kiseljak)	1,200
Bosnian Pyramid Tunnels (average)	40,000-50,000

- The Bosnian Pyramid tunnels exceed all other measured locations, including mountain peaks and ancient sites.
- Compared to natural outdoor air (1,000 NAI/cm^3), the deepest tunnel zones have 40-50x higher ionization.

Key Conclusions

Extraordinary ion levels

- The Bosnian Pyramid tunnels have the highest negative ion concentrations recorded in Bosnia-Herzegovina.
- With up to 50,000 NAI/cm^3, these levels surpass mountain peaks, forests and waterfalls.

Stable underground environment

- Temperature and humidity remain consistent, ensuring a continuous energetic presence.
- High humidity likely enhances negative ion retention.

Potential health and energetic benefits

- Negative ions are linked to immune system boosts, reduced stress and better oxygen absorption.
- The tunnels' high levels could have profound bioenergetic effects on visitors.

Possible underground anomalies

- The unique positive ion increases in certain tunnel sections may suggest unusual underground electrostatic conditions.
- Further research is needed on subterranean water flow and mineral composition to explain this effect.

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Table 11: Bosnian Pyramid Tunnel Ravne prehistorical underground network of tunnels, passageways, intersections and chambers.

No.	Location	Date	Time	Temperature (°C)	Humidity (%)	Negative ions (ions/cm³)	Positive ions (ions/cm³)
1	Outside (in front of the house)	04.04.2024	8:55 AM	10	61	200	300
2	Outside (entrance)	04.04.2024	8:55 AM	10	61	3,500	2,000
3	20m inside the tunnel	04.04.2024	8:55 AM	11	74	3,500	4,000
4	Monolith Egg	04.04.2024	8:55 AM	13.9	74	55,000	39,000
5	K2	04.04.2024	8:55 AM	14.4	74	1,90,000	1,60,000
6	Tunnel No.7	04.04.2024	8:55 AM	13.8	74	2,59,000	2,55,000
7	K5	04.04.2024	8:55 AM	13.4	74	2,90,000	3,03,000
8	Meenal Mehta Tunnel	04.04.2024	8:55 AM	12.9	74	3,00,000	3,31,000
9	Water Tunnel 2010	04.04.2024	8:55 AM	14.5	74	3,30,000	3,35,000
10	160m from entrance	04.04.2024	8:55 AM	13.9	74	3,30,000	3,66,000

Analysis of negative and positive ion trends in the Ravne tunnels

Seasonal negative ion trends (winter *vs.* summer)

- Summer (July 2024) measurements
- **Entrance:** 7,000 ions/cm³
- **Deep tunnels:** 40,000-50,000 ions/cm³

Winter (April 2024) measurements

- **Entrance:** 3,500 ions/cm³ (50% lower than in summer)
- **Deep tunnels:** 259,000-330,000 ions/cm³ (up to 8x higher than summer)

Pattern

- Negative ion levels increase significantly in winter, likely due to stable underground conditions, less ventilation and increased ion retention.

Seasonal positive ion trends (Winter *vs.* Summer)

Summer (July 2024) measurements

- **Entrance:** 6,500 ions/cm³
- **Deep tunnels:** 38,000-54,000 ions/cm³

Winter (April 2024) measurements

- **Entrance:** 2,000 ions/cm³ (lower than summer)
- **Deep tunnels:** 255,000-366,000 ions/cm³ (6-7x higher than summer)

Pattern

- Positive ions surge in winter, which may be influenced by humidity levels and static energy retention in a confined underground space.

Temperature & humidity stability

Temperature

- Summer: 14.3-15.1°C
- Winter: 12.9-14.5°C (slightly lower than summer)
- **Pattern:** The tunnels maintain a consistent microclimate with minor seasonal variations.

Humidity

- Stable at 74% inside the tunnels, regardless of season.
- Minimal external weather influence on underground conditions.

Conclusions

- Negative ion levels increase up to 8x in winter, suggesting a strong seasonal effect.
- Positive ion levels also rise significantly in winter, correlating with humidity changes.
- The tunnel environment remains stable in temperature and humidity, reinforcing the idea of an isolated underground microclimate.

Table 12: Bosnian Pyramid Tunnel Ravne prehistorical underground network of tunnels, passageways, intersections and chambers.

No.	Location	Date	Time	Temperature (°C)	Humidity (%)	Negative ions (ions/cm^3)	Positive ions (ions/cm^3)
1	Outside (in front of the house)	06.05.2024	08:35	8	87	800	500
2	Outside (entrance)	06.05.2024	08:35	8	87	500	600
3	20 m inside the tunnel	06.05.2024	08:35	11.9	73	1,200	1,000
4	Monolith Egg	06.05.2024	08:35	14.4	73	38,000	34,000
5	K2	06.05.2024	08:35	14.6	73	99,000	92,000
6	Tunnel No. 7	06.05.2024	08:35	13.7	73	1,08,000	1,15,000
7	K5	06.05.2024	08:35	13.6	73	1,00,000	1,04,000
8	Meenal Mehta Tunnel	06.05.2024	08:35	12.9	73	70,000	64,000
9	Water Tunnel 2010	06.05.2024	08:35	13.5	73	1,62,000	1,52,000
10	160m from entrance	06.05.2024	08:35	13.5	73	1,20,000	1,30,000

Analysis of negative and positive ion trends in the Ravne Tunnels

Seasonal negative ion trends (spring vs. winter)

Spring (May 2024) measurements

- **Entrance:** 500 ions/cm^3
- **Deep tunnels:** 70,000-162,000 ions/cm^3

Winter (April 2024) measurements

- **Entrance:** 3,500 ions/cm^3
- **Deep tunnels:** 259,000-330,000 ions/cm^3

Pattern

- Spring levels are significantly lower than winter, with up to 5x fewer ions in deeper areas.
- This reaffirms that negative ions accumulate in higher concentrations during winter, likely due to limited airflow and greater atmospheric stability underground.

Seasonal positive ion trends (Spring *vs.* Winter)

Spring (May 2024) measurements

- **Entrance:** 600 ions/cm^3
- **Deep tunnels:** 64,000-152,000 ions/cm^3.

Winter (April 2024) measurements

- **Entrance:** 2,000 ions/cm^3
- **Deep tunnels:** 255,000-366,000 ions/cm^3.

Pattern

- Positive ion levels also show a seasonal drop in spring, again emphasizing a winter peak effect.
- The ion ratios appear to be influenced by the tunnel's electrostatic and environmental equilibrium.

Temperature & humidity stability

Temperature

- **Spring:** 12.9°C-14.6°C
- **Winter:** 12.9°C-14.5°C.
- **Pattern:** Temperature is nearly identical, confirming a highly stable underground environment.

Humidity

- Remains at 73%-74% year-round, regardless of external weather.
- Suggests a sealed microclimate, ideal for maintaining ion concentrations.

Conclusions

- Spring (May) shows lower negative and positive ion concentrations than winter, with up to 5x difference in deeper sections.
- Despite seasonal ion shifts, temperature and humidity remain stable, underscoring the tunnel's isolated and consistent environmental conditions.
- These results continue to validate the hypothesis that the Ravne Tunnel complex contains one of the highest natural concentrations of negative ions in the world, particularly in deeper zones.