

Pockmarks

Pockmark complex at the Troll -field , showing main pockmark , satellite pockmarks (6 or 7) and numerous Unit Pockmarks.

Hovland this Issue, p. 404

Note : Interestingly this exhibits a vortex structure appearance. Some tornado outbreaks exhibit similar patterns.

Special Issue on
Air-Earth Currents



Earth & Space
NCGT International Conference
September 21-24, 2026
Parma (Italy)

See: <https://www.ncgtjournal.com/events>

– *An international journal for New Concepts in Global Tectonics* –

NCGT



JOURNAL

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For donations, please feel free to contact the Research Director of the Geoplasma Research Institute, Mr. Bruce Leybourne, at leybourneb@iascc.org. For contact, correspondence, or inclusion of material in the NCGT Journal please use the following methods: *NEW CONCEPTS IN GLOBAL TECTONICS*. 1. E-mail: leybourneb@iascc.org (files in MS Word or ODT format, and figures in gif, bmp or tif format) as separate files; 3. Telephone, +61 402 509 420. **DISCLAIMER**: The opinions, observations and ideas published in this journal are the responsibility of the contributors and do not necessarily reflect those of the Editor and the Editorial Board. *NCGT Journal* is a refereed quarterly international online journal and appears in March, June, September and December. ISSN number; ISSN 2202-0039.

EDITOR'S CORNER: - Comments by Editor in Chief - Bruce Leybourne**Announcements on Upcoming Conferences - "CALL FOR PAPERS"****21-24 September 2026 – NCGT in Italy****Organized by Valentino Straser (valentino.straser@gmail.com)****Timetable for participating in the conference:**

Open abstract March 1, 2026

Abstract acceptance May 31

Payment due by June 15, 2026 (To organizing committee)

Publication of conference and abstract book September 1, 2026

September 21-24, 2026, International NCGT Conference - Parma, Italy

**Regarding information for authors:**

Abstract: 150 words (maximum)

Short CV: 300 words (maximum) and a photo.

For formatting and fonts, use NCGT Journal.

Abstract submission opens March 15, 2026

Extended: 01 July, 2026**Confirmation of abstract acceptance: July 15, 2026****See: <https://www.ncgtjournal.com/events>****Please visit our "[Events](#)" page above to register, submit abstracts and make hotel reservations.****Field Trip: 23 Sept. 2026 (See next page)**

Late Cretaceous North Apennines

Information website about the city of Parma and its province:**[homepage - Informazioni turistiche su Parma e provincia](#)**

"Earthquake Forecasting with Earth and Space Weather " summarizes the contents of the NCGT 2026 Conference scheduled in Parma, Italy from September 21 to 24, 2026. The NCGT team returns after fifteen years, to discuss Earth model innovations and scenarios for understanding geophysical processes and space weather effects. And, more traditionally, new models of Global Tectonics.

Understanding the Earth today means looking beyond the traditional boundaries of geology and geophysics, combining expertise ranging from electromagnetism to atmospheric physics to space weather. The "Earth & Space" conference was born with this objective: to propose an integrated interpretation of geophysical phenomena, exploring the role of electromagnetic signals as potential precursor indicators of seismic events and analyzing the contribution of new technologies for data observation and interpretation.

In recent decades, studies inspired by the global electric circuit model, a concept developed from the insights of scientists in recent decades, have highlighted how the Earth's atmosphere, ionosphere, and planetary surface constitute an electrically connected system. From this perspective, processes occurring in the lithosphere, including those preceding an earthquake, could produce measurable variations in electromagnetic fields and ionospheric properties.

The conference aims to further analyze the so-called "candidate seismic precursors" of electromagnetic nature, evaluating their potential and limitations considering the latest scientific evidence. The integration of highly sensitive ground-based sensors, satellite networks, and ionospheric monitoring systems opens new perspectives in multi-parametric data collection and modeling of phenomena.

Special focus will be on the role of the Sun. Solar activity monitoring from NASA missions and international space weather programs, indicate influences in the ionosphere and Earth's magnetic field, have potential implications for climate and geodynamic systems. Understanding the interactions between the solar wind, the magnetosphere, and Earth's internal processes represents a crucial frontier for interpreting complex geophysical events from a systemic perspective. "Earth & Space" therefore proposes new interpretative concepts, encouraging us to move beyond compartmentalized visions to embrace a dynamic and interconnected model of the planet. Earth's evolution is not merely the result of endogenous forces but can be interpreted as the product of a continuous dialogue between space and the surface, between solar energy and deep-seated processes.

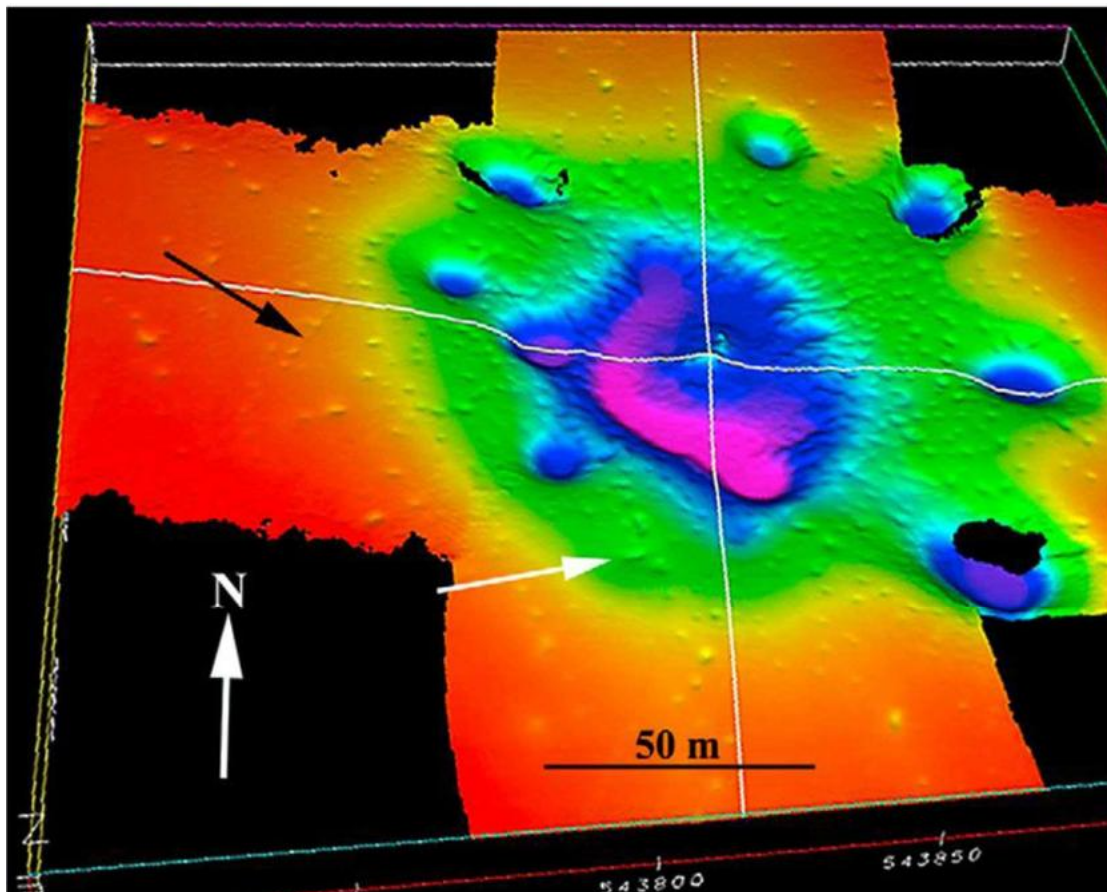
The conference is aimed at researchers, professionals, administrators, and citizens interested in understanding how new technologies and interdisciplinary models can contribute to a more advanced understanding of natural phenomena. It will provide an opportunity for scientific and cultural exchange to explore the future challenges of prevention, sustainability, and risk management on an increasingly complex planet.

Field Trip : 23 Sept. 2026 with focus on Late Cretaceous flysch and ophiolite formations related to the closure phases of the Ligurian -Piedmont Basin. Among the enigmatic formations attracting the attention of many geologists around the world is the "Devil's Leaps." Furthermore , this area, affected by a strike-slip fault, is home to anomalous atmospheric phenomena and unique ionization patterns that precede earthquakes in this geological context of the Northern Apennines.

"North-Eastern Apennines , research has been underway for over 35 years to identify candidates for seismic precursors . First observations collected date back to 1983 along the Taro River Seismic Line , considered by the author to be an 'open -air laboratory '."

See : Straser, 2020 - <https://www.iiisci.org/journal/sci/FullText.asp?var=&id=ZA981US20>

- 1.) Straser - EQ forecasting (Abstracts requested)
- 2.) Leybourne - Stellar Transformer - Global Space Weather interactions (6 Abstracts in Editor's Corner within New Concepts in Global Tectonics Journal - Volume 12, Number 4, December 2024)
- 3.) Anokhin - Lake Ladoga - Siberia (2 Abstracts in Editor's Corner within New Concepts in Global Tectonics Journal - Volume 13, Number 1, March 2025 pp. 5-8, more abstracts requested)
- 4.) Longhinos - Indian Tectonics (Abstracts requested)



Cover Image : Pockmark complex at the Troll-field, showing main pockmark, satellite pockmarks (6 or 7) and numerous Unit Pockmarks. See: Hovland p. 404. Note: Interestingly this has the appearance of a tectonic vortex structure,

Letters to the Editor: Gregori-Leybourne wrap up series on Air-Earth Currents

The present issue completes the series of special issues of NCGT on air-earth currents.

It contains a last-minute invited witness by Martin T. Hovland, concerning his several important findings related to seepology and to the endemic origin of life. This paper is an important source for science historians.

In addition, the present issue contains a concise synopsis of the whole set of papers. The aim is to enlighten the interested reader about the different facets of this classical problem.

If the reader wants to collect these papers altogether, he gets an over ~1,700 pages “monograph”, edited by G. P. Gregori and B. A. Leybourne. The “monograph” fills the gap that existed since the time of Gauss, when Gauss formulated the working hypothesis by which one can approximately neglect the planetary average effect of air-earth currents. By means of this working hypothesis, he could exploit the classical algorithm for separating the internal and external origin geomagnetic field.

Some most relevant topics contained in this “monograph” are as follows, in alphabetical order by author.

Martin T. Hovland, in the framework of his more general investigations on seepology, proved the existence of endemic life generated at the deep bottom of ocean floors. This discovery deserves great emphasis - and hopefully an award - as it is fundamental for justifying the likely existence of life on every object in the universe, wherever the environment permits survival.

Michel Parrot unquestionably proved, by means of the satellite DEMETER, the concrete existence of a significant e.m. (electromagnetic) coupling between solid Earth and ionosphere. This topic was previously largely controversial and Parrot's achievement is a true milestone in Earth's science, which opened the way to several investigations by other scientists.

Luigi Palmieri (1807-1896), the second historical famous Director of the Osservatorio Vesuviano, made unprecedented - and later forgotten - precursory measurements of the electrostatic fall from a volcanic plume. The present “monograph” re-evaluates his relevant investigations, thanks to the help kindly provided by G. Luongo, former Director of the Osservatorio Vesuviano, and by U. Coppa, a scientist of the Osservatorio Vesuviano.

The late John M. Quinn (1946-2020) carried out a remarkable inversion of magnetic satellite measurements, and evidenced the location of huge air-earth currents, particularly in regions of heavy crustal fracturing. We believe that this is, perhaps, the most important finding in geomagnetism after Gauss. The long paper here published reports, posthumously, his results based on some reports poorly known by the international scientific community. We are particularly proud for having fulfilled this important gap of information.

The Tang Maocang School had great achievements, which are almost unknown in the “western” world. The information given in this “monograph” relies on the contribution by two former astute post-graduate scientists (Dong Wenjie and Gao Xiaoqing) of the late Prof. Tang Maocang. Prof. Tang Maocang directed the Institute for Plateau Atmospheric Physics, located in Lanzhou (Gansu Province, PRC). These two excellent friends and scientists, Dong Wenjie and Gao Xiaoqing, spent one sabbatical year each in Rome, visiting G. P. Gregori. We are proud to offer in a series of papers this important information to the “western” community.

In particular, we remind about the history of the formation of the Third Pole - i.e. the Tibet Plateau - investigated by Dong Wenjie together with Tang Maocang. The Third Pole progressively formed and uplifted during the last ~40 Ma and caused the formation of the Hadley cell and trade wind circulation. This result should achieve some important acknowledgment or award.

A most relevant achievement of the Tang Maocang School is represented by the multi-decade records of shallow geotherms, in the upper 3.2 m of soil, in the network of several stations of the Chinese meteorological service. This is an unprecedented facility for monitoring the role of air-earth currents in the control of climate, and it should be applied in other regions.

We deserve a remind about the important achievement - exploited in Rome by Dong Wenjie and Gao Xiaoqing in cooperation with GPG - of the maps of endogenous heat generation, since AD 1400 until nowadays, on the CMB and on the ICB.

One should remind also the study - carried out by BAL in cooperation with D. W. Johnson - on possible arc-blast, as static electricity, or interplanetary lightning short circuits in Stellar Transformers, with particular reference to the North American scenario. See: **Arc Blast as Static Electricity or Interplanetary Lightning Short Circuits in Stellar Transformers:**
https://cdn.prod.website-files.com/679afe6ac395d7fe6d2d4ac5/68213cebd9ea354b308aaf36_NCGTJV13N2.pdf

Letters to the Editor Continued:

This **Arc Blast** investigation applies golden ratio concepts to the global ridge systems and lightning hotspots showing a relationship to the octahedron-cube duality within the tropics, while the poles seem governed by the star-tetrahedron duality. It proposes a possible origin location in the Mid-Pacific for the moon from a Mid-Pacific blown circuit either from solar system plasma overload or collision seems plausible. The presence of dense structures under the Pacific and Africa within the Large Low Shear Velocity Province (Fig. 1), located deep beneath the lithosphere we include as Earth's largest global deep seated induction structures within our local Stellar Transformer and seem linked to the tropical lightning hotspot in the African Congo and the huge volcanic outpouring in Hawaii and Vanuatu. At the ends of the blown circuit joule heating, magma production is fairly continuous. The Bangui Magnetic Anomaly in (Fig. 2) in Congo's central Africa is associated with the tropical lightning zone (Fig. 3) and geoid gravity anomalies (Fig. 4). Revealing what appears to be a diocotron plasma instability (Fig. 5) signature in the gravity and magnetic data related to the flow of African lightning plasma and Pacific volcanic geoplasma (Fig. 1).

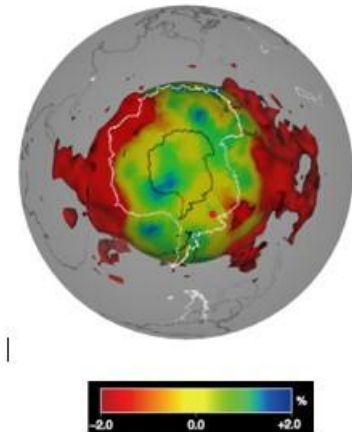


Fig. 1 Africa and Pacific S-wave Seismic tomography model : HMSL -S06 and HMSL -P06 velocity perturbation of S- and P-wave (Houser et. al., 2008).

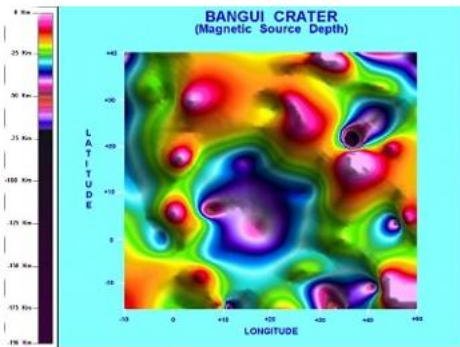


Fig. 2 Bangui Magnetic Anomaly Underlies Gravity and Lightning Anomalies revealing a diocotron instability. From : 61 - 90 spherical harmonics of the mf3 geomagnetic model produced by Stefan Maus NOAA /NGD and Cires in Boulder, CO.

Fig. 3 Congo Lightning Signature of High -Resolution Full Climatology Annual Flash Rate Global distribution of lightning April 1995.

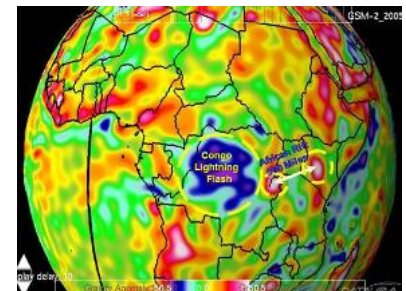
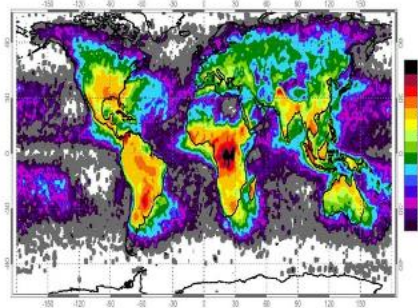


Fig. 4 Congo GGM 02 Geoid model derived from GRACE gravity mission data. GGM02 is latest composite representing the average gravity field over the mission life.

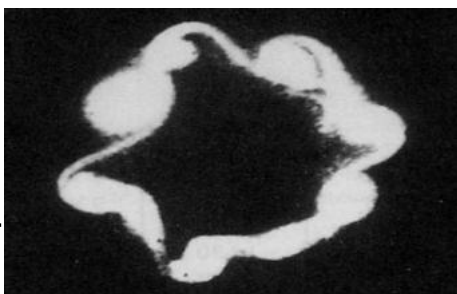


Fig. 5 Diocotron plasma instability

At last, an unexpected by-product was a long paper shared with several co-authors (Gregori, G. P., M. T. Hovland, B. A. Leybourne, S. Pellis, V. Straser, and B. G. Gregori, G. M. Gregori, and A. R. Simonelli) that surprisingly permitted to achieve a reformulation of theoretical physics by avoiding the paradoxes that still bias our understanding since over a century. Reading this paper is hard and uncomfortable. Hence, GPG - in cooperation with his son B. G. Gregori (a neurologist) - published a 306 pages book ("The Universe out of the box" available since December 15th, 2025) that is an epistemological/popular presentation. This important achievement relies on a set of previous papers, where several aforementioned co-authors contributed, altogether with W. Soon.

G. P. Gregori and B. A. Leybourne - Editors of this set of papers on air-earth currents - express their deep gratitude to all co-authors who, by different amount, contributed to the achievement of this result. The Editors are particularly proud for having filled a gap, which existed since the time of Gauss. The co-authors of different papers are, in alphabetical order, F. Bonavia, D. Cataldi, G. Cataldi, U. Coppa, Dong Wenjie, Gao Xaoqing, F. T. Gizzi, B. G. Gregori, G. M. Gregori, M. T. Hovland, D. W. Johnson, G. Luongo, G. Paparo†, M. Parrot, S. Pellis, M. Poscolieri, J. M. Quinn†, A. R. Simonelli, W. Soon, V. Straser, and J. R. Wright.

In addition, GPG incredibly afforded to fulfill a teenage dream - i.e. reformulating theoretical physics by avoiding paradoxes. He had never attained such an incredible result without the either small or large contribution of the discussion with several friends and enlightened scientists. He deserves sincere gratitude to every one of them.

New Book

G. P. Gregori (born 1938), Degree in Physics (1961, Univ. of Milan),

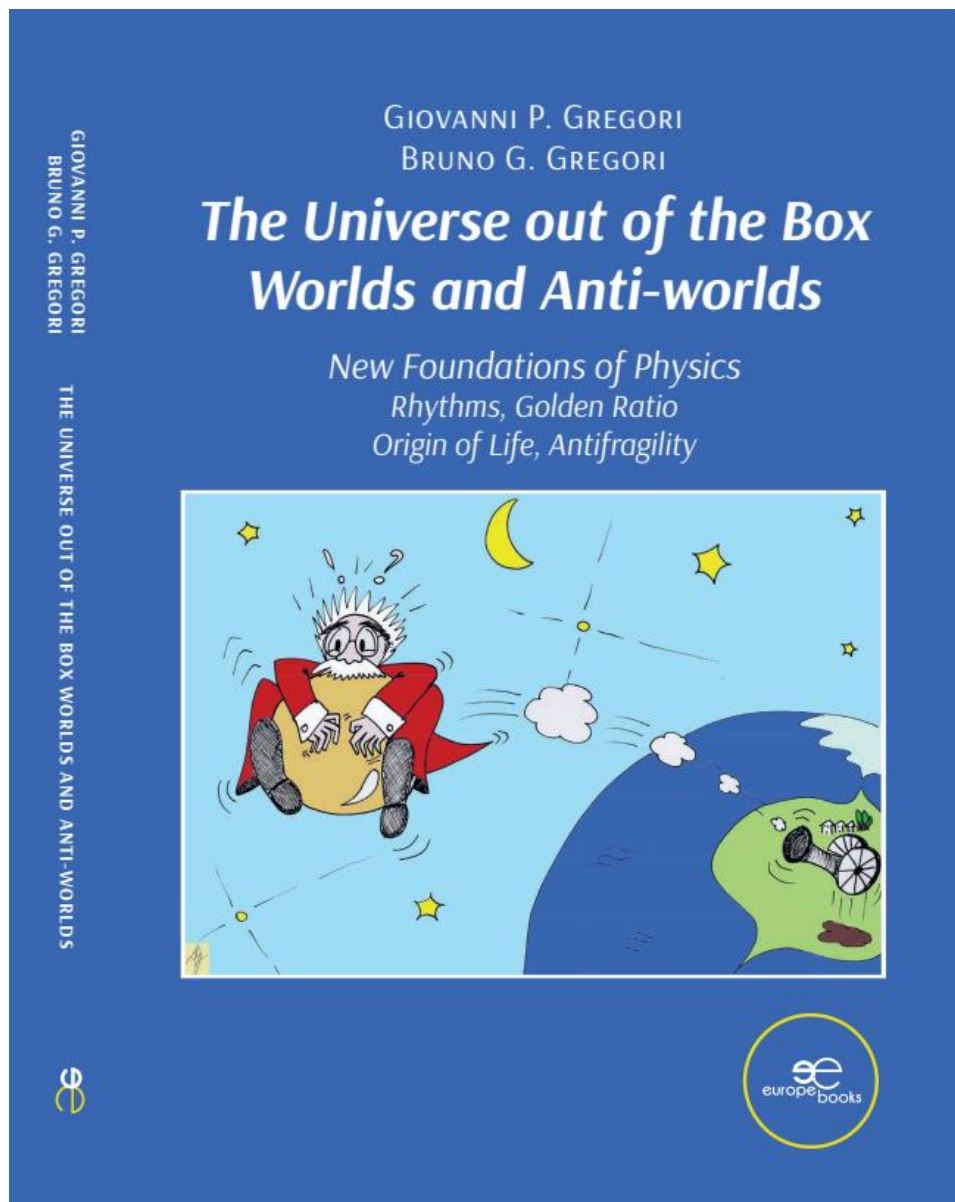
B. G. Gregori (born 1967), Degree in Medicine and Surgery (1992) and Specialization in Neurology (1999)

Science is suffering an identity crisis. Our “widespread scientific knowledge” is “static”.

Our mind dislikes uncertainty. Not relying on the mainstream is uncomfortable, but we gain better awareness of the world and of ourselves. This book is challenging. It stimulates the reader also on a psychological level, and tries to explain concepts that to most people consider abstruse. It is a journey where mind can dance between quantum physics, cosmology, theology, Greek philosophy and the mystery of life and death. Science is logic, and a scientist can never give up. Many present unsolved paradoxes can find a solution.

At present, we are biased by: 3 “original sins” in Newton’s principles, by an Einstein’s mistake, and by a misconception of “absolute” time and of the perception of time passing. A new formulation is presented, which is a substantial advancement compared to Galileo, Newton, Maxwell and Einstein.

<https://www.europebookstore.com/products/the-universe-out-of-the-box-worlds-and-anti-worlds-g-p-gregori-and-b-g-gregori/>



The 18 best discoveries I have done (together with others)

Martin Torvald Hovland¹

¹ *Institute of Geobiology, University of Bergen, (former), Now: Independent researcher, Sola, Norway*

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Background (editorial): Prof. Martin T. Hovland is the discoverer of the endemic generation of life on the deep oceans floor – a fundamental contribution for understanding the possibility of life on other celestial objects - in addition to the wider perspective of seepology. We believe that, altogether, this is one of the most important contributions to Earth science. The scientific discussion is given in the paper Gregori and Hovland (2025; *New Concepts in Global Tectonics, Journal*, 13, (9): 1337-1491). We asked, however, if Prof. Hovland could prepare a “historical” witness of the timing and process of his important discoveries, altogether with several coworkers. We believe that his witness is of paramount importance for future historians of science. We consider a true great honor to host his most authoritative witness, as a completion of our set of several papers on air-earth currents.

Abstract: A historical reminder is made of the timing and implications of the discoveries carried out by the author together with several coworkers.

Keywords: manifestations of vitally important exchange processes - potential terrestrial sources of geological CH_4 - palæo- CH_4 fluxes - potential offshore and oceanic sources of geological CH_4 - terrestrial mud volcanoes - marine mud volcanoes - pockmarks - bioherms - gas hydrates - deep-water corals - crucial role of water and of the biosphere - “unusual” states of matter - salt theory and supercritical water (*ScriW*) - theoretical background - laboratory experiments - the Red Sea - Global Salt Cycle - Serpentinization and serpentosphere - the deepest penetration of water - case histories of evidence of serpentization - water in the mantle – buried hydrothermal systems - evaporites salts on other planetary objects - other unusual states of matter

Introduction

A list is given of key topics, with related key papers, and a few relevant related figures, with some comments.

A full account of the scientific discussion is given in Gregori, G.P., and M.T. Hovland, 2025. Go for the anomaly – a golden strategy for discovery? Seepology & the origin and crucial role of the biosphere - Earth and planetary objects - Supercritical water and serpentization. *New Concepts in Global Tectonics, Journal*, 13, (9): 1337-1491

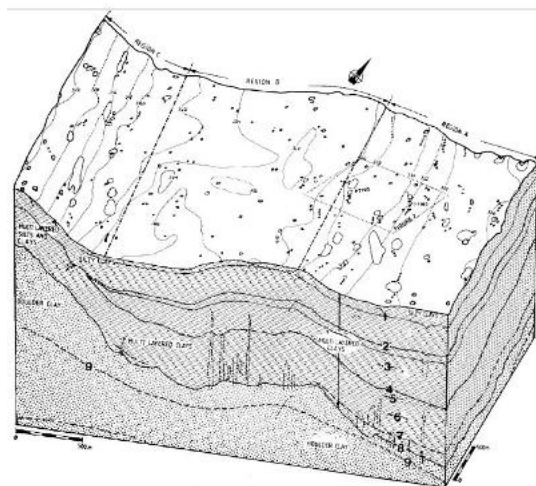
1) Pockmarks: density and characteristics in the Norwegian Trough

Key papers: “A classification of pockmark related features in the Norwegian Trench”. (Hovland 1981) IKU; “Characteristics of pockmarks in the Norwegian Trench”. (Hovland 1981) Marine Geology.

Implications of discovery: This analysis of extensive boomer and side-scan sonar data from the Norwegian Trough in the North Sea implies that:

- 1) Pockmarks have some deep ‘roots’ (acoustically detected) that indicate migration pathways several tens of metres deep (see figs).
- 2) That pockmarks represent exhalation locations for over-pressured gases and porewaters.

CODE	DESCRIPTION	SYMBOL	DATA
S I	Regular Pockmark		SIDE
S II	Irregular Pockmark		SCAN
S III	String of Pockmarks		SONAR
B I	Regular Pockmark		B O O M E R
B II	Assymmetric Pockmark		
B III	Irregular Pockmark		
B IV	Buried Pockmark		
B V	Isolated Hyperbola		
B VI	Sloping Reflector		
B VII	Masking Reflector		
B VIII	Deflected Masking Reflector		



Pockmarks: density and characteristics in the Norwegian Trough

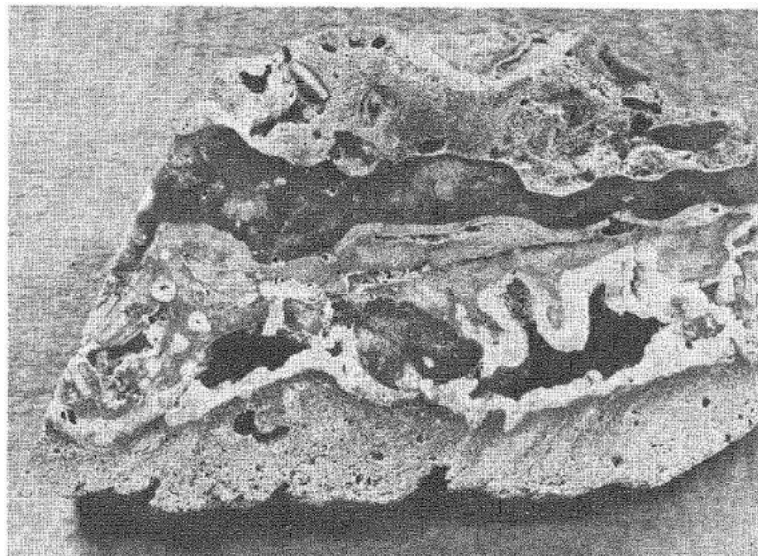
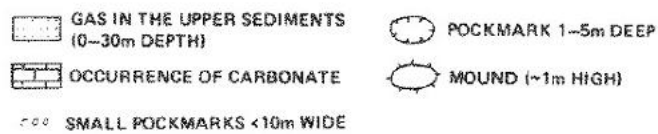
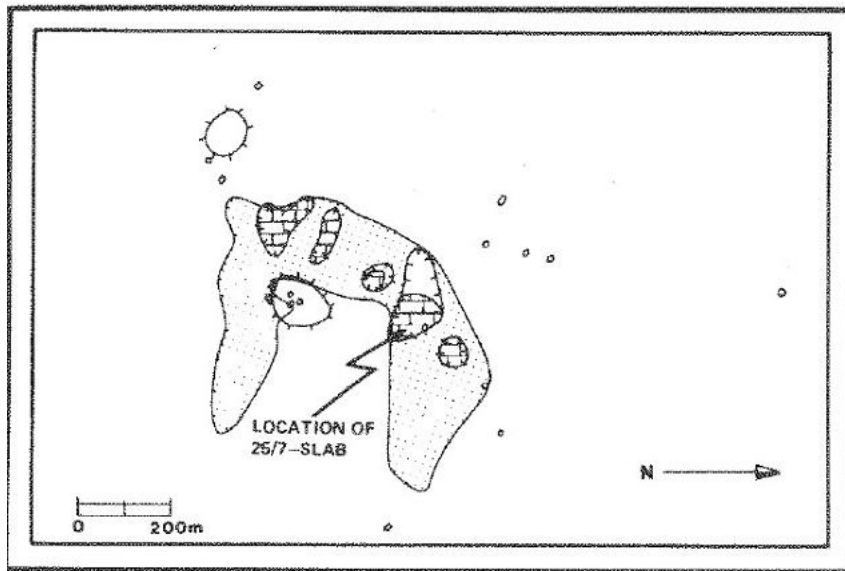
2) Methane derived carbonates (MDACs) from inside pockmarks in the North Sea

Key papers: “Recently formed methane-derived carbonates from the North Sea floor”. (Hovland et al., 1985) Greyham & Trotman; “Methane-related carbonate cements in pockmarks of the North Sea”. (Hovland et al., 1987) J. Sedimentary Petrology.

Implications of discovery: This sampling and geochemical analysis discovery of a relatively large,

pristine rock (slab) from the floor of a pockmark in the North Sea implies that:

- 1) The rock (slab) has been formed in situ on, or within the bottom sediments of the pockmark, and has been cemented by precipitating “methane derived carbonates”, CaCO_3 .
- 2) That anomalous acoustic reflections seen on the seismic recordings across the pockmark must likely be caused by the presence of, or accumulation of shallow methane gas.



Methane derived carbonates (MDACs) from inside pockmarks in the North Sea

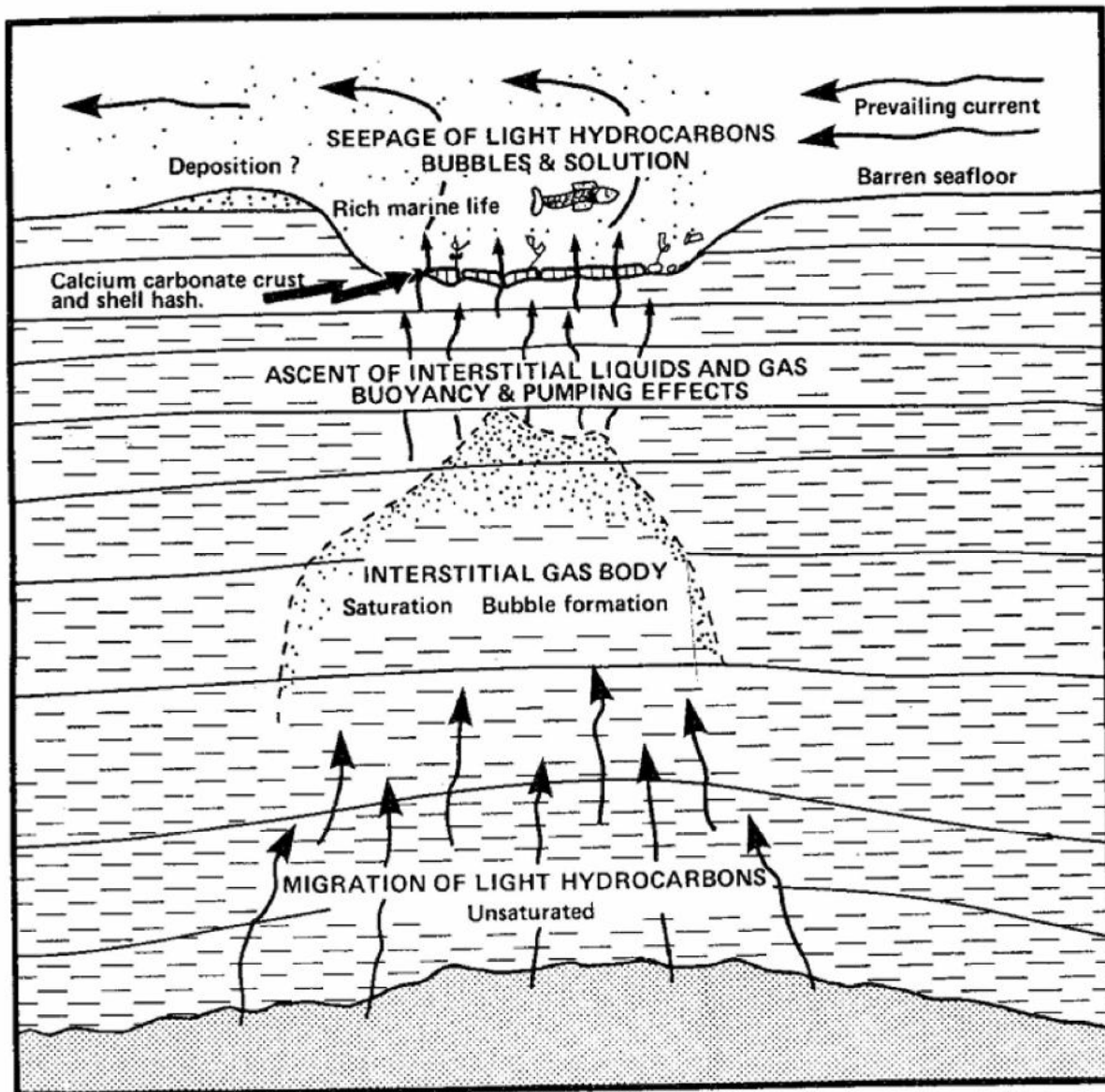
3) High biodiversity inside some pockmarks North Sea

Key papers: "North Sea gas feeds the North Sea fisheries". (Hovland et al., 1989) *New Scientist*; "Hydrocarbon-based communities in the North Sea?". (Hovland and Thomsen, 1989), *Sarsia*.

occurrence of accumulated gas immediately below pockmarks implies that:

- 1) The trapped methane gas likely seeps out of the pockmark either in active periods, or continuously even though no bubbles may be visible, e.g., the gas is then dissolved in porewater seeping out of the pockmark.
- 2) The gas feeds into the food chain via primary and secondary producers.

Implications of discovery: The documentation of both a) relatively deep vertical migration pathways, and the



High biodiversity inside some pockmarks North Sea

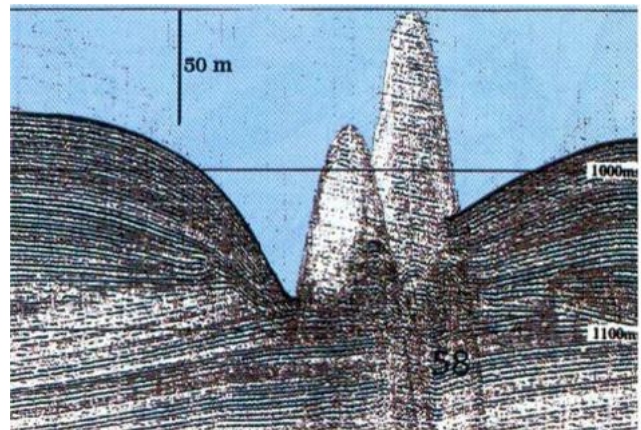
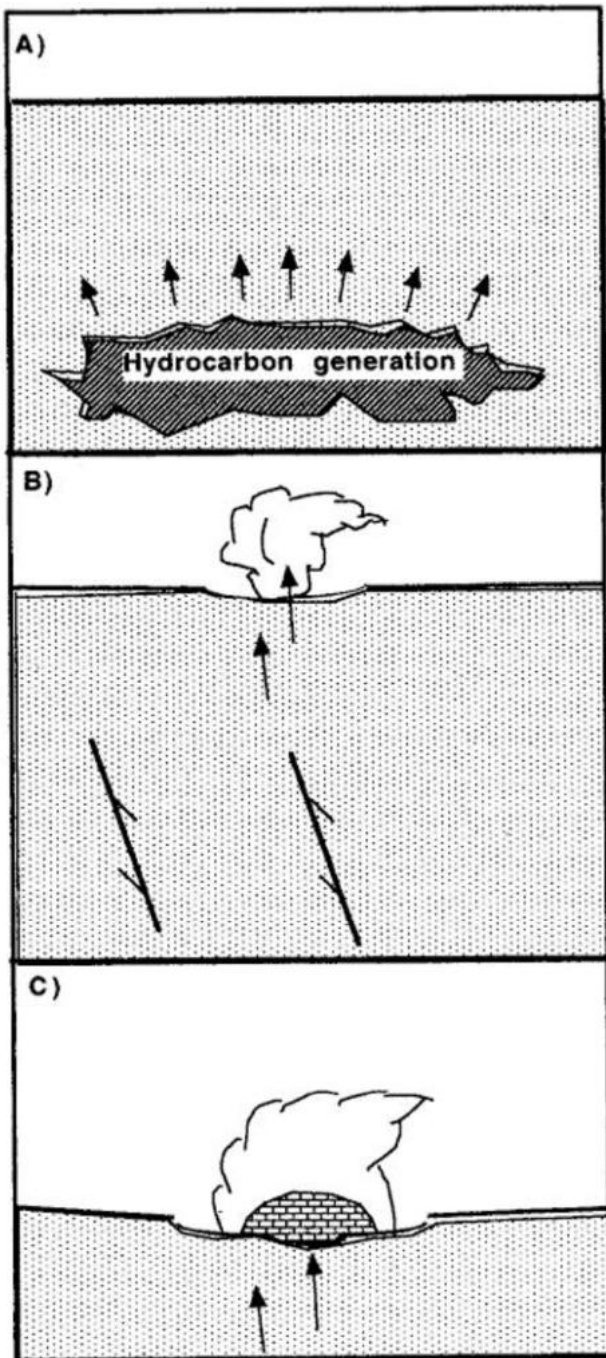
4) Live carbonate mounds in the Porcupine Basin, - dependent on gas migration?

Key papers: “Do carbonate reefs form due to fluid seepage?”. (Hovland, 1990) Terra Nova; “Fault-associated seabed mounds (carbonate knolls?) off western Ireland and north-west Australia”. (Hovland et al., 1994) Marine and Petroleum Geology.

Implications of discovery: The documentation of apparently erratically distributed tall carbonate mounds and

pinnacles, some of which are based inside distinct pockmark depressions, implies that:

- 1) The structures are likely not occurring erratically, but that they likely form above ‘weakness zones’ or zones of vertical fluid movement in the underground. Thus, they bear a similar characteristic as pockmarks and MDAC occurrences in the North Sea
- 2) This means that their occurrence corresponds to seafloor patches of active fluid flow (e.g., patches of ‘hydraulic activity’).



Giant carbonate mounds in the Porcupine basin SW of Ireland

Giant carbonate mounds in the Porcupine basin, offshore Ireland.

5) Deep-water coral reefs north of Polar Circle!

Key papers: “Large cold-water coral reefs off mid-Norway – a problem for pipelaying?”. (Hovland et al., 1994) Oceanology conf.; “Substratum-related ahermatypic coral banks off mid-Norway: Evidence for a link with seepage of light hydrocarbons”. (Hovland et al., 1998) Palaios.

Implications of discovery: After having documented a 15 m tall and 50 m wide coral structure near Fugløy island off

Troms, in 1982 and, also numerous similar structures along the 200 km long pipeline transect between the coast and the Heidun field in 1991-1995, the following implications are inferred:

- 1) That DW corals, including the reef-building stoney coral *Lophelia pertusa* can survive and thrive on the seafloor even north of the Polar Circle.
- 2) At both occurrences (at Fugløy and along the Heidrun pipeline transect), the reefs occur in areas with nearby pockmark formation, indicating fluid flow.



Deep-water coral reefs north of Polar Circle!

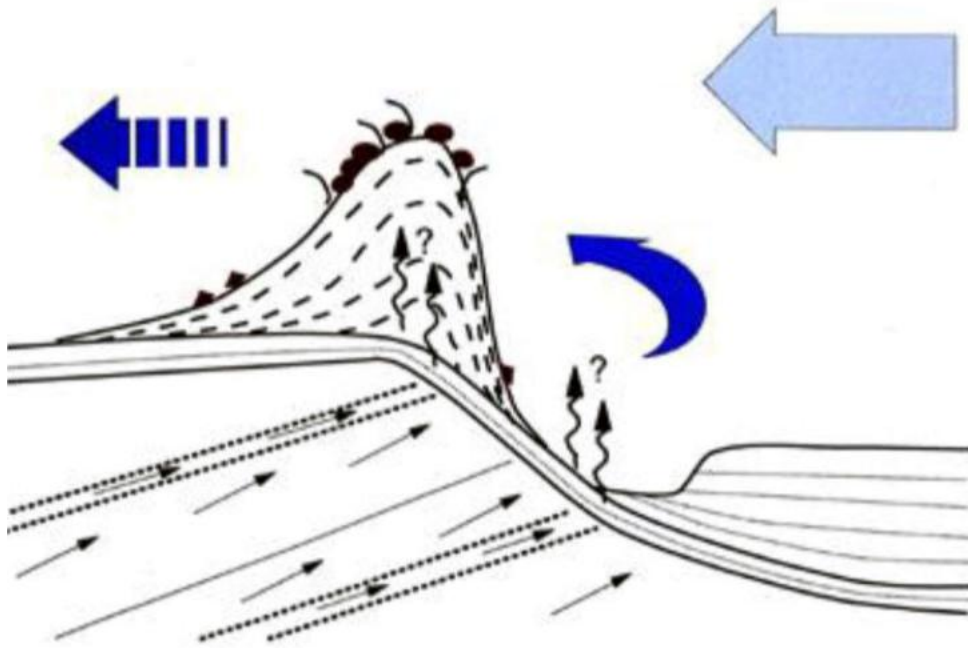
6) Deep-water coral reefs off Mid-Norway rely on sub-surface geology

Key papers: “Large cold-water coral reefs off mid-Norway – a problem for pipelaying?”. (Hovland et al., 1994) Oceanology conf.; “Substratum-related ahermatypic coral banks off mid-Norway: Evidence for a link with seepage of light hydrocarbons”. (Hovland et al., 1998) Palaios.

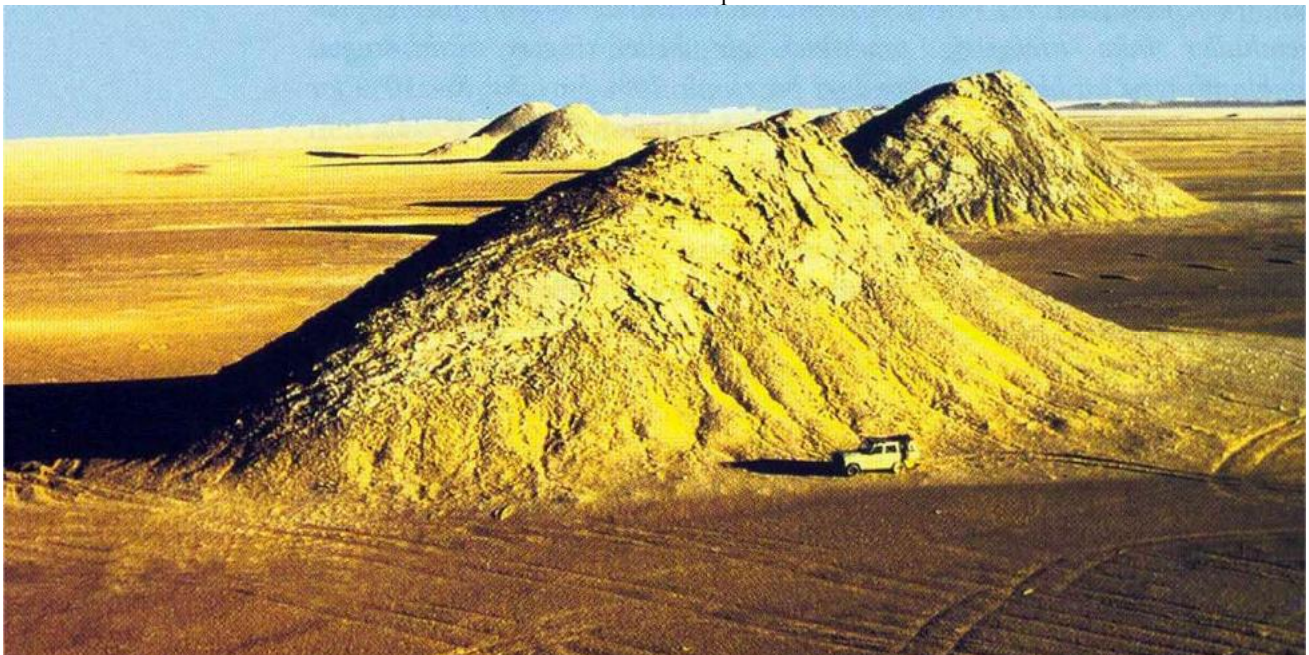
Implications of discovery: The results of widespread geophysical mapping along several pipeline routes,

including the 200 km long Haltenpipe route, has provided a plethora of indicators of seepages associated directly with an increased density (number) of DW coral reefs. This implies that:

The DW coral reefs would probably not have developed into states of ‘prolific growth’ had the nutrients feeding them only been limited to those formed by sunlight, e.g., arriving from the top of the water column. Therefore, it is inferred that seepage of porewater and dissolved gases (CO₂, CH₄, C₂H₆, etc.) has an important local effect on the growth and abundance of DW coral reefs, especially at very high latitudes and regions north of the Polar Circle.



Sub surface nutrient-source for Deep Water Coral Reefs



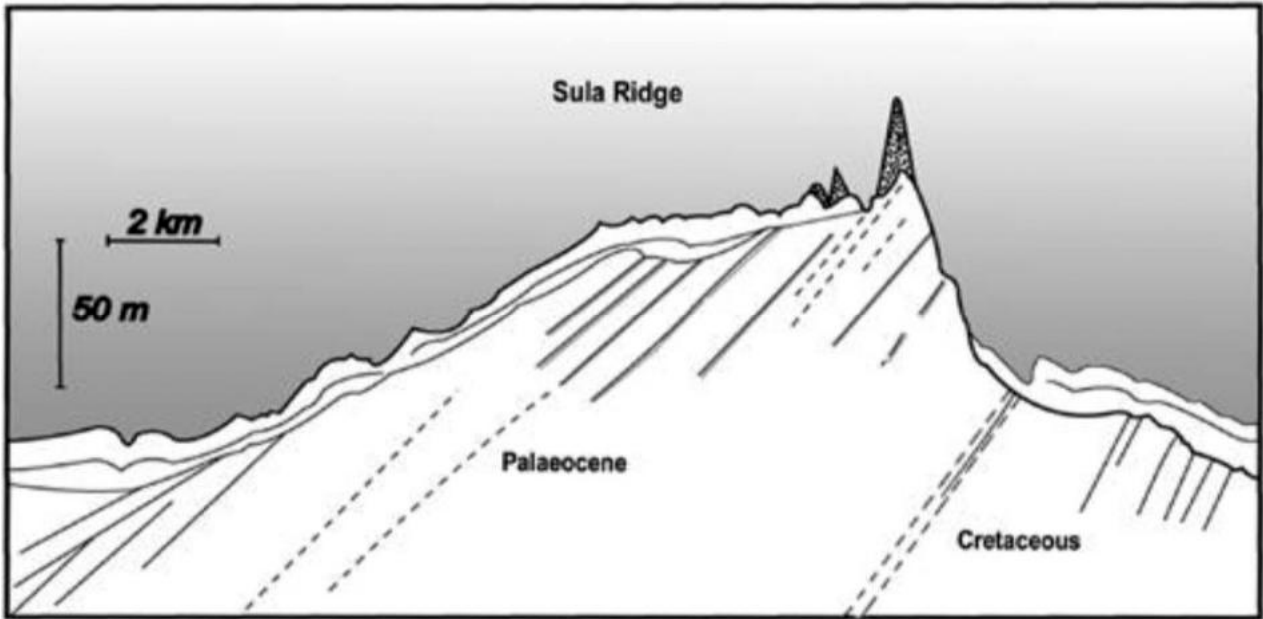
Fossil deep water coral reefs in the Algerian Sahara. Analogous to Norwegian DWCRs. (Photo by Wendt et al.).

7) Deep-water coral reefs grow inside pockmarks at Kristin field

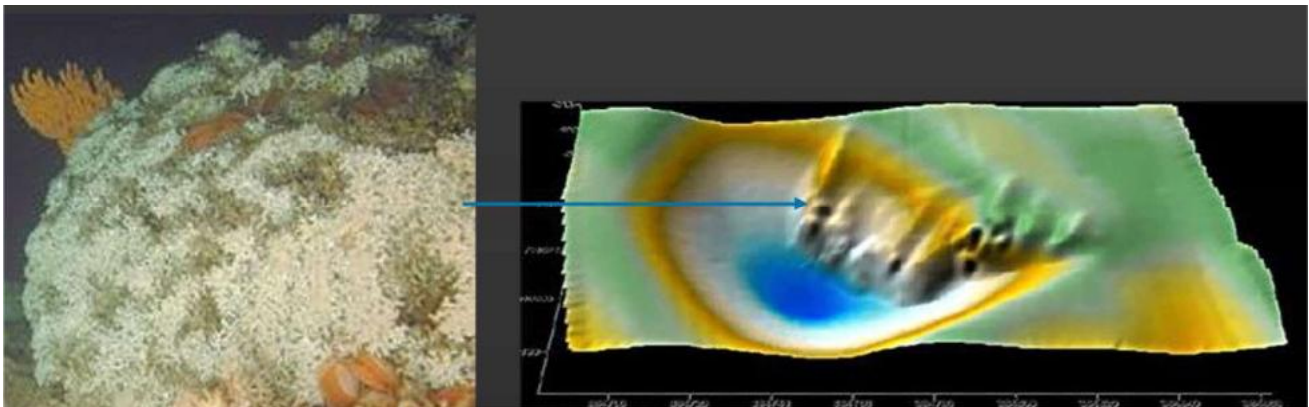
Key paper: “Pockmark-associated coral reefs at the Kristin field off Mid-Norway”. (Hovland, 2005) Springer.

Implications of discovery: DW coral reefs growing inside pockmark depressions at Kristin on Haltenbanken and inside an 8 m deep pockmark at Troll in the Norwegian Trough (North Sea) have the following implications:

- 1) DW coral reefs do not necessarily have to grow on ‘high ground’ (as was previously mistakenly inferred).
- 2) DW coral reefs are tolerant of excessive amounts of sediment particles in the water column. This is because seafloor depressions are locations of excessively turbid water. This especially occurs during periods of higher-than-normal seafloor currents.
- 3) The sediments inside pockmark depressions likely contain abundant organic matter (bacterially produced?) which is utilized by the corals.



Norwegian DWCRs are associated with conditions in the substratum. The large Sula reef is perched on the top of outcropping nutrient-rich Palaeocene sediments.



Pockmark-associated coral reef at Kristin field, off Mid-Norway.

8) **‘Unit pockmarks’ indicate active hydraulic areas on the seafloor**

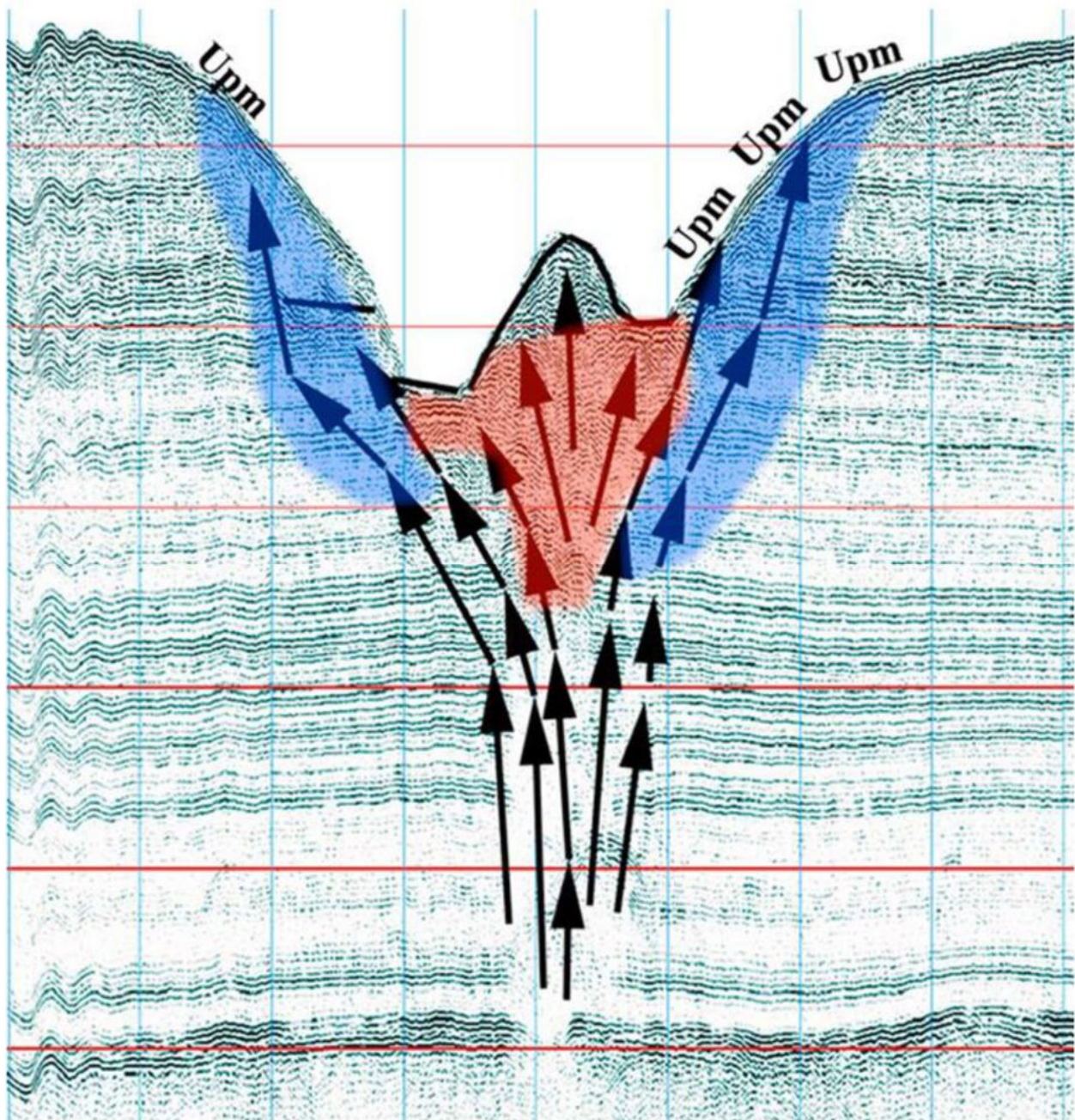
Key paper: “Unit pockmarks associated with *Lophelia coral reefs off mid-Norway: More evidence of control by ‘fertilizing’ bottom currents*” (Hovland et al., 2012) *Geo-Marine Lett.*

Implications of discovery: The observation and visual documentation of patches on the seafloor with high relative densities of small (<5 m diameter) and up to 0.5 m deep pockmarks have the following implications:

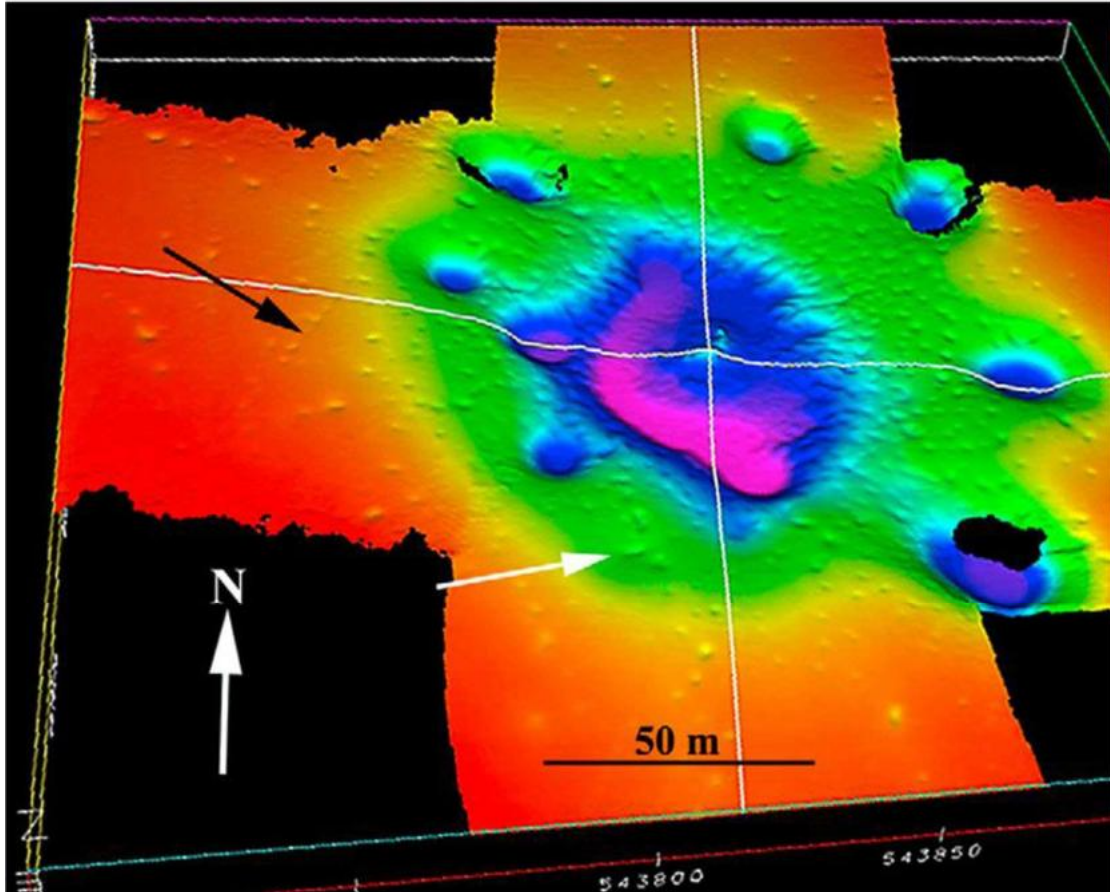
1) The upper seafloor sediments record relatively weak or feeble hydraulic processes within the deeper

sediments. One example from the Troll field in the Norwegian Trough (North Sea) shows that Unit pockmarks are abundant along visible trawl-marks (scars) on the seafloor. This likely means that a mechanically induced disturbance of the uppermost layer of sediments may induce a hydraulic effect (e.g., increase the local permeability of the sediments). Thus, the disturbances open up new pathways or conduits for the slightly over-pressured sub seabed fluids to escape through.

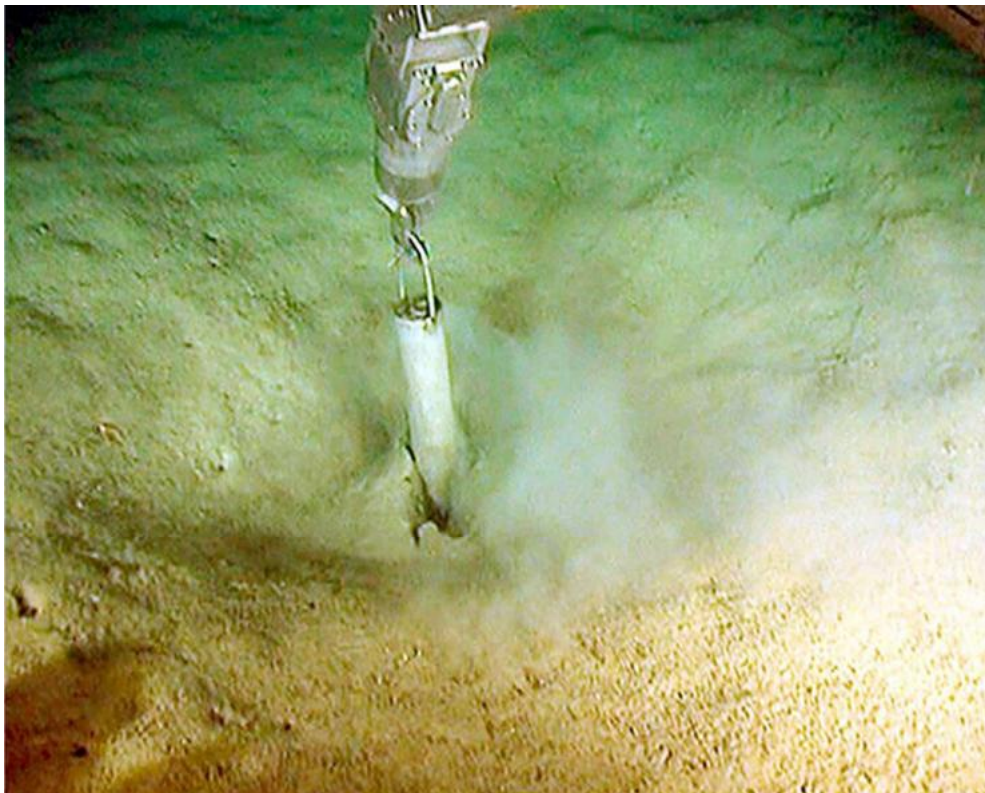
2) That the mapping of Unit pockmarks is useful as a tool to determine patches of seafloor where there is currently ‘hydraulic activity’, and where there is a potential for the formation of new normal pockmarks and/or development of DW coral colonies.



Large pockmark with numerous Unit Pockmarks (Upm) at Troll, North Sea



Pockmark complex at the Troll-field, showing main pockmark, satellite pockmarks (6 or 7) and numerous Unit Pockmarks



Sampling a Unit Pockmark off Mid-Norway. Elevated concentrations of methane – propane

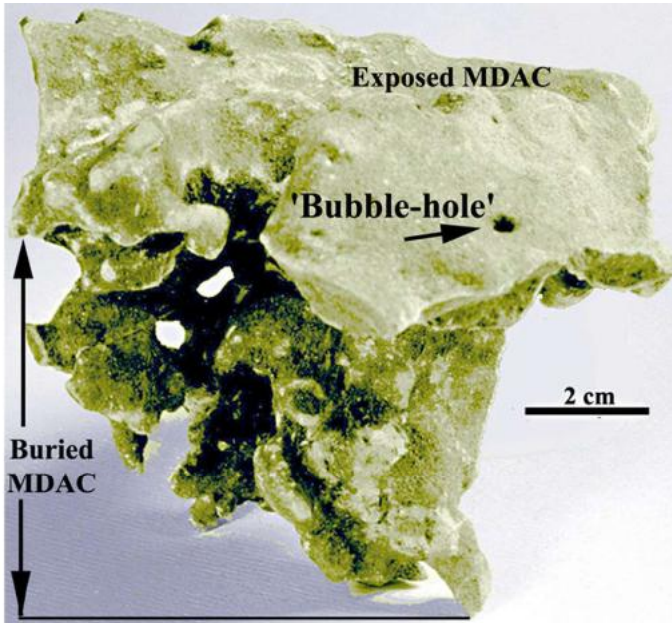
9) 'Self-sealing seeps'

Key paper: "On the self-sealing nature of marine seeps".
Hovland, 2002, Continental Shelf Research.

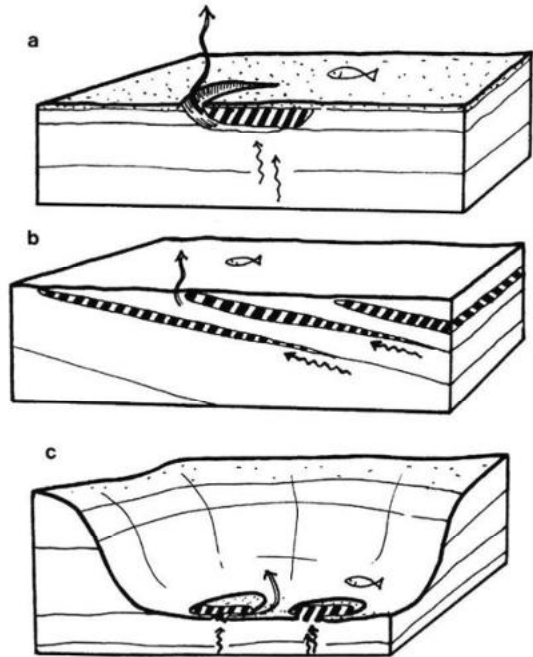
Implications of discovery: The observation of several large, complex pockmarks in the Troll-area of the North Sea, have tell-tale patterns that suggest a relatively simple temporal development history.

1) sealing by MDAC of the main (central) pockmark causes the development of several new 'satellite' pockmarks in the 'complex cluster' ('family') of pockmarks.

2) This pattern of pockmarks is likely developing to maintain the maximum fluid flux and depletion of underground over-pressure. As pockmarks seal up, one after the other, the flux moves to another nearby location where the sediments are still porous and permeable.



MDAC with vent hole at Tommeliten seeps, North Sea



'Self-sealing seeps'

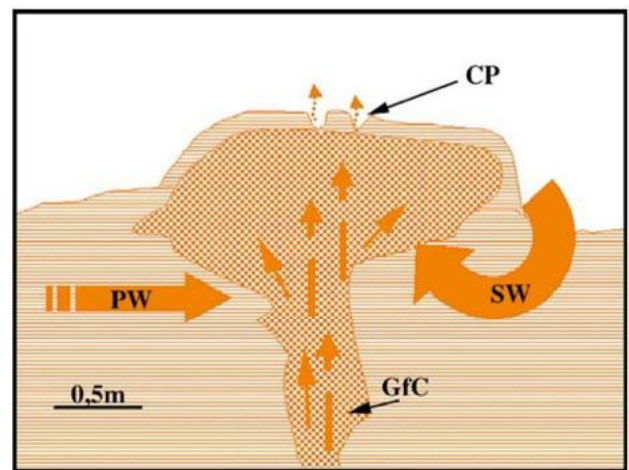
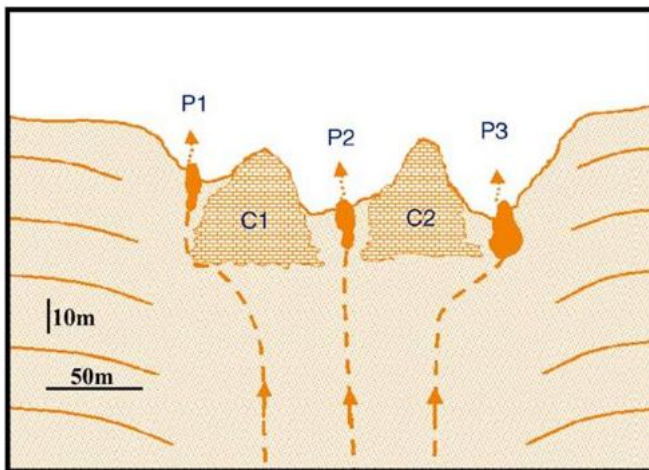
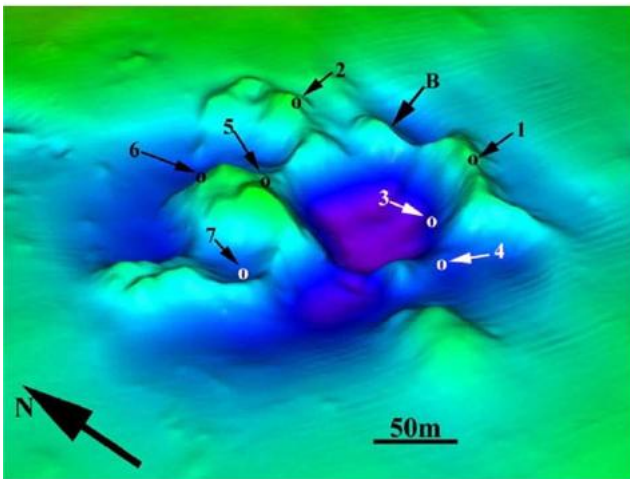
10) ‘Gas hydrate pingoes’ at Nyegga

Key Paper: “Submarine pingoes: Indicators of shallow gas hydrates in a pockmark at Nyegga, Norwegian Sea” (Hovland & Svensen, 2006); Marine Geol.

Implications of discovery: Terrestrial ‘pingoes’ form in areas with permafrost as a consequence of sub-surface ice accumulation, which is caused by a depressed H₂O partial pressure over ice crystals forming in the sub-surface sediments. We infer that a similar accumulation occurs as

hydrate crystals form in the sub-surface in a marine setting. ‘Hydrate pingoes may form in regions of prolific gas seepage, such as at Nyegga. This implies that

- 1) Local gas hydrate accumulation caused by a lower partial pressure for H₂O at the gas hydrate formation location, causes water molecules to migrate through the sediments to the hydrate locations, thus forming mounds (i.e., ‘pingoes’). Thus, these features form where the gas flux is high and water can flow to the sub seafloor locations where hydrate formation occurs.



Hydrate Pingoes

Air-Earth Currents - A Synopsis

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Abstract: We present a concise synopsis and reminder of today knowledge of air-earth currents. We refer to a large set of published papers, everyone dealing with a different facet of air-earth currents. The problem is classical. Gauss had speculated a working hypothesis, and assumed that the planetary mean of the effects of air-earth currents is negligible. At his time, this seemed a reasonable assumption. Thus, he could define the algorithm by which he afforded to separate the geomagnetic field of internal and of external origin. The topic became a classic, until the agreement to compute every 5 years an *International Geomagnetic Reference Field (IGRF)*. This procedure became one of the best known and classical features in geomagnetism, while the former Gauss' assumption was taken for granted, even though a proof - either in favor or against his original working hypothesis - was never exploited. Only very seldom some authoritative scientists emphasized the need to fill this gap. The large set of published papers - which is here shortly outlined - is a reply to the previous lack of critical analysis. Compared to almost two centuries ago, the knowledge of Earth science much evolved, and the overall scenario that is here presented stimulates a keen analysis of the logical foundations of our knowledge of Earth science.

Keywords: air-earth currents - climate control and climate change - atmospheric circuit - soil exhalation - ground and satellite monitoring - exploitation of the electrostatic energy of the atmosphere - electrostatic cycle of the Sun - magnetospheres and cometospheres - energy processes in the magnetosphere - global atmospheric circuit - soil exhalation and the tetrahedron - Cowling theorem and Cowling dynamo - atmospheric potential gradient - nature of an electrical discharge - Fukushima theorem - Space Weather - jet stream and seismicity - supercritical water - seepology - origin of life - planetary objects - shallow geotherms - seismic precursors - long-range and large-scale climatic prediction - lesser evidences of air-earth currents - energy release from *ALB*, *CMB* and *ICB* - secular variation - autopoiesis - antifragility - survival strategy - "statistics" and generalized chaos

Introduction

Air-earth currents are associated to every electric current that crosses through Earth' surface. Gauss assumed as a working hypothesis that, maybe, the planetary mean of the effects of air-earth currents can be considered negligible. By this reasonable assumption, he could implement the separation of the geomagnetic potential into two potentials, one dealing with the external origin geomagnetic field, and the other with the internal original field. The topic became classical, and today a new model of the internal origin geomagnetic field is computed, conventionally, every 5 years, named *International Geomagnetic Reference Field (IGRF)*.

Only seldom some outstanding scientists remind us about the unproven Gauss' hypothesis, stressing the need for a check. Vestine (1967) wanted to compute the circuitation of the geomagnetic field - i.e., the integral of the field along a closed loop - observed at Earth's surface.

Since $\text{curl } \mathbf{B}$ is proportional to the air-earth current \mathbf{j} , in principle this is the most direct way to check the Gauss hypothesis, although it is almost impossible to carry out it. The need for a critical re-evaluation of the problem was stressed, e.g., by the late Naoshi Fukushima, who for several years served as *General Secretary* of *IAGA*,

However, these authoritative voices were isolated and led to no new substantial critical analysis, while the "general consensus", based on the *IGRFs*, grew almost like a paradigm, seemingly forgetting about any critical concern.

At present, several observational evidences are available, collected during almost two centuries, and a critical evaluation is possible, looking at different facets of the global electrical circuit, from the Sun through the deep Earth's interior.

The present synopsis is therefore equivalent to a ~1,700 page monograph, composed a set of several published papers, so that the reader, who is interested at one given

facet of this key problem, can promptly find a suitable paper dealing with his main concern.

The global perspective

Gregori et al. (2026a) is a general perspective of the global Sun-Earth circuit, and of the way the Sun, through the solar wind, controls the generation of the Earth's endogenous energy. The Earth's interior acts like a true battery that is charged by the tidal interaction originated by the Moon and by the Sun.

Every battery stores energy, and releases it at a later time. The storage of energy can occur in different ways. The best known way is by means of chemical transformations, such as in a standard car battery. Another way is by means of huge capacitors. The third way, which is operative inside the Earth, is a transformation of the state of matter. The correctness of this mechanism is proven by the observational evidence of the secular variation (*SV*) of the radius of the inner core (*IC*).

The state of matter inside the Earth is solid within the crust, and it changes progressively *vs.* depth until it becomes plastic, corresponding to the progressive increase of ambient temperature, caused by the increasing lithostatic pressure (i.e. by the weight of the overlying layers).

Thus, the Earth's mantle is progressively less rigid *vs.* depth, and finally the outer core (*OC*) is in a fluid state. That is, all crystalline bonds break, and the medium becomes more and more ionized *vs.* depth, in a state that is called "*metallic state*" - according to the term used by planetologists when dealing with the outer large gaseous planets. This term stresses the availability of a huge amount of free conduction charges, i.e. of free electrons.

However, when all ions fully lose all electrons that are trapped on their orbitals, the "*naked*" nuclei can no more capture or emit photons. Thus, the *IC* is characterized by "*naked*" nuclei, which repel each other due to electrostatic repulsion. On the other hand, the "*naked*" nuclei are firmly compressed by the overlying layers of the Earth. Therefore, the *IC* is gravitationally confined, and the "*naked*" nuclei are compelled to interact with each other, through their respective nuclear magnetic moments.

This is the state of the *IC*, where all nuclear magnetic moments are firmly packed together, due to a strong mutual attraction by nuclear magnetic moments. The *IC* is thus in a "*fibrous*" state, where all nuclear magnetic moments are closely parallel one another.

This is the explanation of the overwhelming part of the geomagnetic field. Thus, the Earth looks like a huge dipole, just like a uniformly magnetized sphere. This state of matter is called "*magpol*" (acronym for magnetic polarization). This explains the reason why S wave propagate through the *IC* - unlike through the *OC* - while it is certain that the *IC* cannot be in a "solid" state - in contrast with what is general nonsensically stated - because no crystalline bond can exist.

Note that the *magpol* state has zero electrical conductivity, due to the total lack of any free conducting charge (electron). In addition, the *magpol* state can emit (or absorb) no photon, i.e. it is invisible, it is "*dark*", or it is "*dark matter*", which is likely to be the most frequent state of matter in the universe.

The mechanisms of the generation and release of endogenous energy from deep Earth are critical for the problem of air-earth currents. For a summary and some details refer to Gregori et al. (2026a) and Gregori (2002).

A key feature is here reminded, concerning a deep pattern of energy source, located along the sides and at the vertices of a *tetrahedron*, with one vertex at the geographic North Pole (Gregori and Leybourne, 2021). This pattern has important consequences for air-earth currents, and for planetary climate. The effect is mainly evident over the entire Arctic cap.

Before dealing with a general treatment of the several intricate evidences of air-earth currents, some lesser related phenomena are focused in Gregori et al. (2026b).

Methodological premises

For future reference, we want to recall two key issues, which are fundamental for the present discussion.

One item is classical, i.e. *variation principles*. That is, as a standard, the best-known standard approach to physics relies on elementary laws applied to infinitesimal parts, which compose a given system, to be later integrated to some macro-dimension. Conversely the *variation principle* addresses large-scale integral quantities that, depending on their definition, must be either at a minimum or at a maximum.

Differently stated, independent of the specific details referring to the micro-scale, the final pattern of the system must satisfy a basic variational requirement. This topic is classical and is reviewed in its historical perspective by Gregori et al. (2025e).

The second topic, much innovative compared to standard "generally agreed" science, deals with the classical *Cowling theorem*, and is outlined in Gregori et al. (2026d).

In 1919-1920, following the discovery and mapping by Babcock of the magnetic field *B* on the Sun, Larmor proposed that a huge dynamo - active inside every star - is responsible for the generation of the stellar *B*. The model was correct and is now investigated by solar and stellar astrophysicists in ever increasing detail.¹

However, in the 1930s Cowling proved a classical theorem. He showed that every system - with *perfect* cylindrical symmetry - cannot originate a dynamo. This turned out to be a true and well-known nightmare for every solar and stellar astrophysicist. The theorem was later proven in several ways, everyone by means of reasonable assumptions, but the result was always the same.

Only in 2002, Gregori (2002) proved the *generalized Cowling theorem* with no assumptions, being much like a

¹ The same model was later proposed for explaining the dynamo inside the Earth. This is incorrect (Gregori, 2002). The history is outlined in Gregori and Leybourne

(2025aa). The superrotation of the *IC* has been successfully investigated by Gregori et al. (2025y).

universal theorem that applies on every scale, from the microscale through the gigantic galactic clusters. However, Gregori formerly did not realize that he had proven this important theorem.

The *generalized Cowling dynamo* claims that, under very general conditions, every system of charged particles with an internal dynamics² is an effective dynamo that, in general, can display only one of the two possible patterns shown in Fig. 1. Fig. 1a has poloidal \mathbf{B} and toroidal \mathbf{E} , while Fig. 1b has poloidal \mathbf{E} and toroidal \mathbf{B} . The theorem states that case (a) is *unstable*, hence it is never observed, while case (b) is *stable*. However, the argument shows that, in the case of ideal cylindrical symmetry, the stable case (b) has null energy, i.e., the classical Cowling theorem is correct.

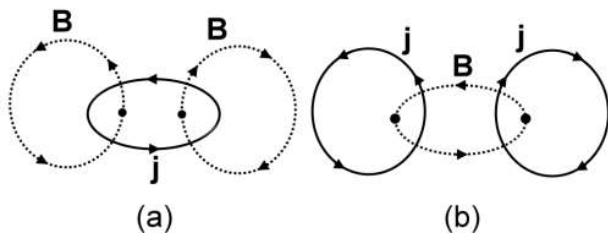


Fig. 1 – Idealized scheme of every most general dynamo composed of charge matter that has some internal dynamics. Only two configurations are possible. Case (a) has a mere poloidal \mathbf{B} and toroidal \mathbf{j} or \mathbf{E} . Case (b) has a mere toroidal \mathbf{B} and poloidal \mathbf{j} or \mathbf{E} . The generalized Cowling theorem states that case (a) is *unstable* while case (b) is *stable*. Concerning the classical Cowling's theorem, it is shown that, in either case, even a *perfect cylindrical symmetric* configuration attains the maximum possible dynamo performance, even though the total energy of the stable dynamo of case (b) is null. In contrast, with no cylindrical symmetry the energy for case (b) is not null. For instance, no cylindrical symmetry occurs when the axis of symmetry of figure (b) is not the same as the rotation axis of the system. After Gregori (2002) and Gregori et al. (2026d). With kind permission of the late Wilfried Schröder.

Refer to Gregori et al. (2026d) for a list of several applications, including the explanation of previous apparently mysterious phenomena. We stress that this is a *very general rigorous theorem*, almost like the Pythagoras theorem, with unexpected implications.

The physics of electrical discharges

As a preliminary step, one must define the meaning of “electrical discharge”. Even one electron, which moves in a given reference frame, is an electrical discharge. In the literature one often finds complains about the fact that, in general, electrical discharges were investigated with respect to the possible related damages or hazard (e.g., concerning lightning), while much lesser concern was devoted to the primary physical phenomena involved in a “discharge”.

A set of three papers (Gregori and Leybourne, 2026e, 2026f, 2026g) is needed to review this intricate topic, where

² An internal energy source is essential to supply dynamics in order to avoid the implication of the virial theorem applied to plasmas (Chandrasekhar and Fermi, 1953)

– among other items - the application of the generalized Cowling theorem plays a crucial role.

Several different phenomena are discussed, from small-scale occurrences, including fog and atmospheric precipitation, through ball lightning (BL), runaway breakdown (RB) and terrestrial gamma flashes (TGFs), and the Gurevich and Karashtin effect (GK effect), through sparks and lightning, the electrostatics of the ionosphere, transient luminous phenomena (TLEs), plasma jets collimation, Birkeland currents and sea-urchin spikes, stellar and galactic alignments.

The Sun and interplanetary environment

Air-earth currents are a crucial part of the global Sun-Earth electrical circuit. Therefore, we must first clarify the physics of the Sun.

The electrostatic Sun, and the electrical charge of the solar wind

The first item, which disagrees with the present generally accepted feeling, deals with the electrostatic phenomena that occur on the Sun, and with the consequent electrostatic charge of the solar wind. This topic is discussed in Gregori and Leybourne (2026b).

The leading principle begins from the aforementioned Larmor dynamo, which is responsible for the generation for the observed, and generally erratic, \mathbf{B} observed by Babcock in the photosphere. Owing to the generalized Cowling theorem, the whole Sun should be confined by a huge toroidal \mathbf{B} , almost like by a gigantic toroidal magnetic bottle. Hence, as a strict matter of principle, we should be forbidden even from observing the Sun. In reality, in the case that the solar confinement is “*perfect*”, the Sun cannot release the enormous energy generated by the internal nuclear (both fission and fusion) reactions. This effect can be called “*Biermann blocking*” (see Gregori, 2002 and Gregori et al., 2026a).

In effect, the Sun is a permanently exploding body, aimed to expel the huge amount of endogenous energy. This permanent explosion explains why we observe no regular pattern of the solar \mathbf{B} . This explosive process leads to the steady expansion of the solar corona, which is identified with the solar wind flow.

In any case, the Sun is permanently characterized by an intense \mathbf{B} that looks erratically distributed in its large patterns, corresponding to the large size of the expulsion of huge amounts of plasma. In principle, this explosion plasma is composed of free electrons, of protons - and also of ions, more or less stripped of their respective electrons that are eventually trapped on their spectral orbitals. A key property to be considered is therefore the gyration radius of every charged particle trapped along the local field lines of \mathbf{B} . Therefore, the electrons have a gyration radius several thousand times smaller than protons and ions.

that claims that no plasma can be self-contained by the magnetic field \mathbf{B} generated by itself.

In 1941 Biermann emphasized that one cannot understand how electrons can lose temperature within sunspots, due to the enormous intensity of the local \mathbf{B} . This is the reason of the aforementioned term “*Biermann blocking*”.

In any case, as already mentioned, owing to the need of energy balance, some hot plasma must exhale explosively from the Sun, due to the enormous endogenous energy originated by thermonuclear reaction. This is the solar wind.

Electrons, however, are much more firmly trapped on their gyration radii around the \mathbf{B} field lines. Hence, the solar wind is mainly composed of positively charged particles (protons and ions) that, compared to electrons, are less firmly trapped on their gyration radii.

Thus, *the electrostatic charge of the solar wind is positive*, while the Sun progressively increases its total negative charge.

On the other hand, this phenomenon cannot progress indefinitely. In fact, the ever-increasing electrostatic repulsion of the excess electrons on the Sun finally determines the expulsion of electrons through huge van de Graaff accelerators. Therefore, gigantic electron jets cross through the photosphere and look dark, like sunspots, due to local lack of ions.

These gigantic clouds of electrons impact on the Earth’s magnetosphere - and on all other planetary objects. On the Earth they cause the most spectacular auroræ, associated to electron precipitation, in contrast with the much feebler proton auroræ.

When the Sun has exhausted a relevant fraction of the excessive negative charge, the magnetic bottle is newly effective, and the Sun starts anew to release positively charged solar wind and to increase the solar negative charge.

This is an original explanation of the mysterious mechanism behind the sunspot cycle.

“Frozen-in” \mathbf{B} and the “transparency” of the solar wind

A classical, although often somewhat misunderstood, concept deals with the so called “*frozen-in*” \mathbf{B} in the solar wind. In fact, consider the relation

$$\mathbf{j} = \sigma \left(\mathbf{E} + \frac{1}{\gamma_0} \mathbf{v} \wedge \mathbf{B} \right) \quad (1)$$

and, whenever $\sigma \rightarrow \infty$, in order to keep \mathbf{j} finite, we must assume

$$\mathbf{E} + \frac{1}{\gamma_0} \mathbf{v} \wedge \mathbf{B} = \mathbf{0} \quad (2)$$

or it is stated that the Lorentz force exactly opposes the electric force. This is the co-called Alfvén theorem on the “*frozen-in*” \mathbf{B} .³ This can be explained as follows.

Imagine that, everywhere in space, an infinitesimal electrical circuit is located that has $\sigma \rightarrow \infty$. Whenever some time-changing electromagnetic (e.m.) field impinges on this circuit, the induced currents - which are associated with an

infinite σ - abruptly “capture” the entire external impinging perturbing field. The induced currents totally neutralize it.

Therefore, the e.m. field, which is eventually actually observed, must be only - and strictly only - the e.m. field that is transported by the infinitely conducting matter, because every other field is totally damped off and screened: indeed, every other field is just canceled.

A different way is to refer to the (vanishing) Joule heat within this infinitesimal circuit, which has infinite σ (refer also to Gregori, 2002).

In fact, the energy, which is captured by the infinitesimal local circuit with $\sigma \rightarrow \infty$, is entirely locally spent through Joule dispersion, which can be described by means either of $[\mathbf{j}^2/\sigma]$ or of $[\rho V^2]$, where V is the e.m.f. that is induced in the elementary circuit with $\sigma \rightarrow \infty$. Even upon allowing for the role played by the formal mathematical (and not physical) divergence of ρ , either forms $[\mathbf{j}^2/\sigma]$ or $[\rho V^2]$ imply a finite (actually a vanishing) absorption of Joule dispersion. That is, we must consider the form $[\mathbf{j}^2/\sigma] \rightarrow 0$ when $\sigma \rightarrow \infty$, unlike the form $[\rho V^2] \rightarrow \infty$ (for finite V).

Differently stated, the physical fact that the field \mathbf{B} is transported by matter requires that we should treat the phenomenon like a \mathbf{j} generator, rather than like a V generator, or - by using the wording of the Alfvén “*frozen-in*” theorem - the requirement of keeping \mathbf{j} finite implies that the e.m. field is embedded and “*frozen-in*” the moving matter.

Summarizing, the substantial physical difference is thus stressed, between the role of Maxwell’s displacement currents in vacuum vs. the role of the “*frozen-in*” fields that move and are transported by a $\sigma \rightarrow \infty$ medium.

The phenomenon - in terms of a college physics analogy - reminds about the reflection of a light beam from a mirror - when it is justified in terms of a process of e.m. induction into a conductor (see Corson and Lorrain, 1962, Ch. 11). The mirror phenomenon is aimed at minimizing the perturbation, which is caused by the impinging light beam on the physical system that composes the mirror. But, according to this interpretation, a “mirror” is assumed to be characterized by a vanishing physical “skin-depth” of penetration of the light beam into the reflecting surface. This is an ideal situation, equivalent to the ideal assumption of $\sigma \rightarrow \infty$.

Therefore, if the solar wind has an ideal $\sigma \rightarrow \infty$, it operates everywhere like a *perfect reflecting* mirror and no e.m. signal can cross through the solar wind. Hence, we *could not even see the Sun*.

Conversely, we know that a large band of e.m. radiation, including radio frequencies, is crossing through the solar wind. This can occur due to the violation of the ideal assumption of $\sigma \rightarrow \infty$ in the solar wind.

On the other hand, the assumption of almost $\sigma \rightarrow \infty$ can explain the well-known spiral structure of the interplanetary magnetic field \mathbf{B}_{int} (also known as *IMF*).

³ The concern of G. P. Gregori about understanding the true physical meaning of the Alfvén “*frozen-in*” theorem was

the former motivation that triggered Gregori (2002), hence also the present whole study on air-earth currents.

Magnetospheres and cometospheres

Magnetospheres are the object of an extremely wide amount of literature. There is no need to remind here about several aspects reported by a huge number of records carried out by clouds of satellites and space probes.

We stress, rather, that the generally accepted model of the Earth's magnetosphere is based on a semi-empirical interpolation on the available observations. Several crucial items, however, are thus left unexplained - e.g. the physical explanation for the formation of the neutral sheet.

These items are discussed either in Gregori et al. (2026a), or in Gregori and Leybourne (2025m), where the realistic possibility is discussed that comets also develop a magnetosphere (hence, called *cometosphere*).

Suitable possibilities are also envisaged about how the observed morphology and properties of comets can confirm this possibility. If this interpretation of the cometary morphology is confirmed, comets are extremely useful natural probes suited to monitor the properties of the solar wind through the entire extension of the expanding solar corona.

Energy processes inside the magnetosphere

A particular and much intricate item deals with a physical discussion of the energy processes inside the magnetosphere. An extensive discussion requires quite a lengthy paper (Gregori et al, 2025z), and the results cannot be here shortly summarized.

Chapman-Vestine currents and Birkeland-Alfvén currents – The Fukushima theorem

A classical, and formerly largely controversial, item deals with the geometrical pattern of electric currents \mathbf{j} in the atmosphere, as they can be observed at Earth's surface, currents \mathbf{j} that originate the geomagnetic \mathbf{B} of external origin.

The former proposal, dating back to an article of *Encyclopedia Britannica* by Balfour Stewart (1882) and later supported by Chapman and Bartels (1940) and by Vestine,⁴ envisages currents \mathbf{j} flowing at almost constant altitude over the Earth's surface.

A competitive model envisages, rather, electric currents \mathbf{j} flowing along \mathbf{B} field lines and precipitating mainly over the polar caps. This model was formerly envisaged by Birkeland and later supported by Alfvén. These are called Birkeland currents, or also field-aligned currents (*FACs*).

The controversy persisted until a devoted and vivid meeting that was specifically convened at Sandefjord, in the Oslo fjord, in 1967. In fact, both kinds of currents exist.

The Chapman/Vestine currents are associated with the thermal and tidal dynamics of the upper atmosphere. In contrast the Birkeland/Alfvén currents typically always occur over the polar caps.⁵

⁴ Several papers report these classical historical details.

⁵ Some phenomena are of mixed character. The equatorial electrojets is an atmospheric dynamic phenomenon. Polar electrojets are a combination of *FACs* and atmospheric dynamics. The celebrated ring current is

After the Sandefjord meeting, while flying back to Japan, the late Naoshi Fukushima discovered what is now called the *Fukushima theorem* (Gregori and Leybourne, 2026h), by which he showed that it is impossible to recognize either one current system, or the other, by means of ground based \mathbf{B} records alone. At present, an increasing huge number of observations by means of satellite and space probes confirms the co-existence of the two current systems.

The Fukushima theorem is now of mainly historical interest, but, concerning geomagnetism, it remains one of the most brilliant findings of the 20th century.

Sunspot variations. Impact on the Earth and on other planetary objects

The definition of sunspot number is empirical, because often sunspots look clustered together, while solar observatories have different resolutions etc. Hence, historically, solar astronomers agreed to count sunspot groups and to assume that every group is equivalent to 10 sunspots.

In fact, sometimes all sunspots look clustered in just one group. Hence, it seems that the Sun is less active than at other times, as the sunspot number is substantially lower. Conversely, even with very few sunspots, the Sun is very active. This is the explanation of the so-called "*MiniMax*" sunspot cycle.

Physically, this means that the "standard" better known four-sector pattern of *IMF*, that is one sector away (+), one sector towards (-) the Sun, one sector + and one sector -, shifts to a pattern with two large sectors, one + and one -.

The Sun, and its *IMF* sector pattern, rotates with a mean speed of ~ 27 days. Hence, with "normal" 4-sector pattern of *IMF*, the Earth and every planetary object experiences an e.m. variation with period $\sim 27/2$ days. In contrast, during *Minimax* time with two large *IMF* sectors, the Earth and every planetary object experiences an e.m. variation with period ~ 27 days. These long period e.m. variations affect the *TD* dynamo (tide-driven dynamo) of every planetary object, which implies a larger generation of endogenous energy.

This effect can be detected both on the Earth and – maybe - by observing anomalous large storm in the atmosphere of the large gaseous outer planets. These items, which are often quite intricate, are discussed to some extent by Gregori et al. (2026c) and Gregori and Leybourne (2026c).

Currents across the Earth's surface

After completing the discussion of the solar and interplanetary segment of the huge solar/terrestrial loop of currents \mathbf{j} , we shift the focus on air-earth currents that cross through Earth's surface.

mostly associated to a longitudinal drift of trapped radiation in the magnetosphere. That is, the ring current is a magnetospheric phenomenon, being neither associated to *FACs*, neither to atmospheric dynamics.

A fundamental premise and warning concerns the experimental records of the electric field E at ground.

The former measurements were started in the middle of the 19th century at the same time when - following the great activity by Gauss and von Humboldt - also B measurements were started, being the beginning of the present large network of geomagnetic observatories.

The fate of E measurements was, however, unsuccessful. Even when *IGA* attempted (by the authoritative initiative of Juan G. Roederer) to reconsider the whole ensemble of the available historical E records, the conclusion was definitely frustrating. All available records denoted no regularity of any kind, envisaging that they were biased for some unknown reason, and in any case they were completely useless for any significant investigation.

In fact, when evaluating the significance of the records, one must take into account a double drawback: one is *instrumental*, the other is (maybe) *physical*.

The *instrumental* drawback derives from the incorrect definition of two electrodes. Hence, the recorded potential difference derives from an incorrect setting of the electrodes, and is devoid of any geophysical significance.

Indeed, one electrode was assumed to be ground, by supposing that the whole Earth is an efficient conductor. This is certainly incorrect. Apart from the Galvanic potential associated with a grounded electrode, the Earth is crossed by huge, induced currents, in response to the external origin e.m. induction originated by the solar wind. The telluric currents that flow - at any given time instant and at any given site - can originate everywhere on Earth, even at an antipodal location. Hence, no reliable reference can be made to a grounded electrode.

The definition of the other electrode faced the relevant concern of the contact with air. The use of a feeble ionizing source, produced by a small amount of radioactive material, was frequently used, being, however, unreliable. In fact, the perturbation being originated in the natural system is much larger than the effect to be measured.

The use of “*mill devices*” appeals to a cyclic insert and removal of a plate (i.e. of a Faraday screen) over a metal point. However, every use is unreliable, either of tiny spikes that are associated to a corona discharge, or the use of falling drops (because a small drop transports more charge than a large drop). In addition, these devices suffer from rapid saturation.

The other warning deals with the *physical* drawback, and, in principle, is unavoidable. In fact, one must consider the realistic possibility that the recorded E experiences dramatic variations in space and time even on extremely short distances and on extremely small time intervals. This is evident, e.g. when discussing the mysterious mechanisms of water condensation and precipitation in the atmosphere, or of fog formation, etc. See the aforementioned mentions about the physics of electrical discharges.

Therefore, the ultimate realistic concern is about the frequency of a time varying signal, and about the sensitivity and precision of the recording instrument.

In any case, a correct E record must rely on measuring the induced j that flows inside a closed loop that is rapidly rotating, with no need to define either electrodes of any kind, or their contacts with air and ground. This item is discussed in Gregori and Leybourne (2026d).

Another much innovative topic deals with satellite monitoring of air-earth currents, as extensively explained in Quinn et al (2026). To our knowledge this Quinn’s finding seems to be *the most important achievement in geomagnetism since the times of Gauss*.

Let us briefly summarize this item. The Quinn’s key idea deals with the inversion of satellite magnetic records. Every inversion problem is well known to be indeterminate. In fact, an observed field, for instance either of gravity or of geomagnetic field, e.g. of large intensity, can be originated either by a close and weak source, or by a distant and strong source.

The late John Quinn, while inverting geomagnetic records, added one physical constraint. He imposed that the inverted value for the crustal electrical conductivity must be comprised between physical boundaries, i.e. between a minimum and a maximum possible value.

He applied his unprecedented inversion technique to 6 months of records of the magnetic satellite *CHAMP*. This resulted in a heavy computational job that could be carried out only by a particularly learned and trained scientist.

He found *frequent and widespread* patterns of “*double-eye*” patterns, composed of two approximately equal-size areas at Earth’s surface, each one with the shape of an ellipse, surprisingly and regularly divided by a thin linear divider.

Quinn interpreted these features as evidence of different magma inclusions associated with some kind of super-volcanoes. On the other hand, no other geological or geophysical datum supports the existence of such a curious kind of volcanic activity (i.e., frequent occurrence, and *thin* divider between opposing magma inclusions). In fact, remnant magnetism generally supports some ancient volcanic - usually basaltic in nature, or maybe associated with ancient meteorite impacts (Quinn, 2012). However, the aforementioned “*double-eye*” patterns have a size much larger than these remnant patches of magnetism.

Conversely, we interpreted these patterns as evidence of huge and intense soil exhalation, along linear structures, associated with intense air-earth currents j . This interpretation is strengthened by the Quinn’s finding that these features are associated with areas of particularly intense crustal fracturing. In this sense, this finding is of paramount importance, as it is a (negative) observational check of the aforementioned former classical working hypothesis by Gauss - who assumed that the mean planetary pattern of air-earth currents can be neglected, thus allowing to implement his classical algorithm for separating geomagnetic field of external and internal origin.

When we communicated our realistic interpretation to John Quinn, he did not agree. Maybe, we guess that he was a very kind person, and he did not like to contradict his

astute and skillful colleagues who had computed the models of the geomagnetic field by means of the same satellite records that he used.

In fact, these really astute and much accurate models of the geomagnetic field used only carefully selected periods of time, with the quietest possible geomagnetic conditions. They assumed *a priori* that all air-earth currents flowing through the satellite orbit had been excluded. Conversely, the principle of our objection is shown in Fig. 2.

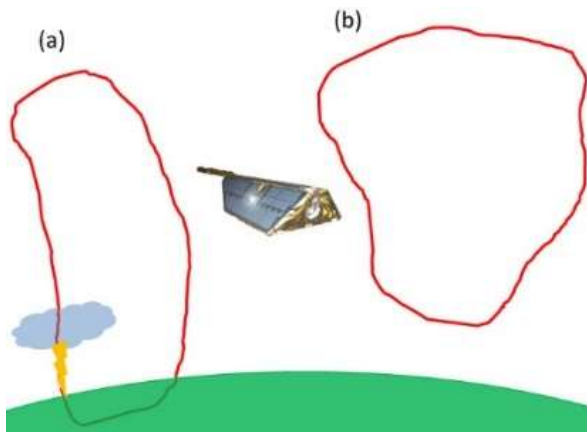


Fig. 2. A satellite magnetometer detects the effect of every closed \mathbf{j} -loop that can indifferently flow everywhere, either crossing [case (a)], or not [case (b)], through Earth's surface. The \mathbf{B} records carried out by satellite magnetometer are unreliable only if the satellite crosses through a region, where a flow of charged particles occurs. All other records monitor the effect of every current, either air-earth or not. This is just a matter of principle. In contrast, Quinn claimed that the *SHE* models he used had been computed by excluding the role of air-earth currents. See text. After Quinn et al (2026).

This Quinn's finding is of unprecedented and paramount importance, a truly *great discovery*. The results are contained in a few long reports, which are unfortunately basically unknown to the large audience of Earth scientists. The posthumous paper Quinn et al (2026) aims to fill this gap, and to acknowledge the immense value of Quinn, a truly great scientist. In the interest of transparency, the original interpretation provided by Quinn is thoroughly documented in Quinn et al. (2026).

Interaction with the atmosphere

The interaction of air-earth currents with the atmosphere - up to the ionosphere and magnetosphere - were formerly a largely debated topic, until the satellite *DEMETER* showed - in an unquestionable way - the real physical connection between air-earth currents and the atmosphere.

Parrot (2025) is a most authoritative synthesis of the main results of his crucial findings.

On the other hand, this topic is now the object of a large amount of papers by several authors, who implemented additional detailed investigations. The topic is now classical and extensive, and cannot be here reviewed.

The Tang Maocang School

Another important and huge topic that is poorly known in western literature deals with the investigations by the school of the late Prof. Tang Maocang, who directed the *Institute for Plateau Atmospheric Physics*, located in Lanzhou (Gansu Province, PRC).

The information here mentioned derived from a one-year sabbatical year spent, in subsequent years, by two astute and brilliant post-graduate former students of Prof. Tang, i.e. Dong Wenjie and Gao Xiaoqing. They spent their sabbatical year in Rome at the *Institute for the Physics of the Atmosphere (IPA, by CNR)* in close cooperation with one of the authors (GPG). The full responsibility of the report, which is here given, is of the first two authors (GPG and BAL), although the content is an attempt to report as faithfully as possible the original thought of the Tang Maocang School.

The report here given is a set of five papers devoted to air-earth currents.

The first paper (Gregori et al., 2025f) is an accurate reminder, aimed to set order in the difficult realm of troponins, attempting to get rid of the confusion - which arises from referring to the same morphological feature by means of Latinized characters of the original Chinese terms.

The second paper (Gregori et al., 2025g) reports about a most brilliant result by Dong Wenjie and Tang Maocang. They show how the 40 *Ma* long history of the uplift of Himalaya and of the Tibet Plateau resulted in the final generation of the Third Pole of the Earth, in terms of a large ice sheet cover. This impacted climate in a tremendous way, generating the previously non-existent Hadley Shell pattern, which originated the trade winds and changed the planetary climate pattern. This finding is almost unknown in the "western" community, and it is certainly worthy of some most important award.

The third paper (Gregori et al., 2025g) reports some relevant results of the main investigations of the Tang Maocang School. They recorded what we call "*shallow geotherms*". They measured - at the stations of the *Chinese Meteorological Service* and they recorded by hand operator at a conventional time - the temperature inside holes in ground, at 320 *cm*, 160 *cm*, 80 *cm*, 40 *cm* depth and at ground surface. They carefully discussed and separated all records according to the presence of atmospheric precipitations and/or snow cover, etc.

They found that the 40 *cm* depth record is basically useless. Conversely, the deeper records resulted extremely useful for long range (several hundred kilometer) and long time (a few months) "forecast" of the expected atmospheric precipitations. That is, the likely former object of their investigation was motivated by the search for earthquake precursors, while their records resulted into a most interesting tool for climate "forecast". In fact, for several decades (at least) they issued regular long-range forecast of climate change for the Chinese government.

The success of their approach resulted from the concurrence of several factors. China has a subcontinental

size, and the records were collected in a uniform way over a large network of points. In addition, China is a mixture of several different morphological areas, including the Tibet Plateau, long rivers, loess plateau, desert areas, etc. Moreover, The Tibet Plateau is a large area characterized by a large amount of exhalation of endogenous thermal energy, originated by the large amount of friction-heat resulting from the steady push of India, caused by the uplift of the Kerguelen superswell, which determines the steady uplift of Himalaya.

In any case, this monitoring technique should be hopefully extended on the planetary scale and applied to all emerged land, as this is a way to monitor directly - at every site - the time variation of soil exhalation associated to air-earth currents.

The fourth paper (Gregori et al., 2025i) reports several results dealing with the palæo- and archæo-climate in the Chinese subcontinent. These items could not be included in the previous papers.

The fifth paper (Gregori et al., 2025j) reports about topics in palæoclimatology, and about the role of the biosphere for air-earth currents. This paper relies on results dealing with regions other than the Chinese subcontinent. These items are related to the previous papers, although they could not be included in the previous discussion, and were collected altogether into a unique final paper for the sake of completeness.

The release of endogenous energy

A set of six papers reports part of the result of the investigations carried out in Rome during the sabbatical years of Dong Wenjie and of Gao Xiaoqing. The focus was on the computation of the release of endogenous energy on the planetary scale, deriving from the *TD* dynamo.

The full responsibility of these investigations relies mostly on GPG alone. However, these results were achieved only due to the exceptional skill of two excellent friends and scientists, i.e. Dong Wenjie and Gao Xiaoqing. GPG misses them very much, both like scientists and like very nice friends, in addition to being fantastic coworkers.

The first paper (Gregori et al., 2025k) reports on the observational database used for subsequent investigations.

The second paper (Gregori et al., 2025l) deals with methods, with the “*principle of magnetic energy variation*”⁶ and with the computation of Joule heat on a spherical shell of currents.

The third paper (Gregori et al., 2025m) carries out a physical analysis, with the estimate of self-energies and radii, and with the Lowes-Nevanlinna (*LN*) law and related secular variation (*SV*).

The fourth paper (Gregori et al., 2025n) addresses to a physical analysis, and to the Poynting theorem and the estimate of the ratio s/σ , i.e. of the ratio between the thickness s of a spherical shell - which is the equivalent j -

circuit of the j -currents that flow either on the *ALB*, or *CMB*, or *ICB* - and the respective electrical conductivity σ .

In addition, the roles are discussed, separately, of terms of the geomagnetic potential associated to different degree n of the *SHE* expansion of the geomagnetic field. A physical explanation is considered concerning the role of the “*magpol*” *IC* in the *TD* dynamo.

The fifth paper (Gregori et al., 2025o) presents the results, and the sixth paper (Gregori et al., 2025q) is an atlas - computed by Gao Xiaoqing - of the Joule heat released at the *ALB*, *CMB* and *ICB* during AD 1400 through present. This Gao Xiaoqing achievement is quite relevant.

The origin of life

The next topic deals with the relation between air-earth currents - i.e. ocean floor exhalation of endogenous energy - and the endemic origin of life on the Earth - and consequently also on other objects in the Universe. The literature is now widespread and, maybe, it is even premature to attempt to review the several studies that are in progress.

Our set of papers focused on air-earth currents wants, rather, to celebrate the great precursor of this important discovery, i.e. Prof. Martin T. Hovland, who had the opportunity to get advantage of facilities that no university or research institution had available. His great skill, his “instinct” worthy of the most famous scientists of the past, supported him in accomplishing an impressive amount of investigations.

We invited him to write an extensive account of his multifaceted investigations. However, he could not carry out such a job. Hence, GPG offered to prepare a draft. Martin T. Hovland accepted although he wanted GPG to be the first author, even though the content is absolutely only from the merit of M. T. Hovland.

It is a true honor for us to host this paper (Gregori and Hovland, 2025) that celebrates the paramount important precursory contribution by one of the greatest living scientists. It is impossible to summarize in a few statements the enormous different contributions made by M. T. Hovland, and the interested reader should refer directly to Gregori and Hovland (2025).

In addition, the mere historical perspective of the several findings by Prof. Martin T. Hovland and his coworkers is outlined by the important witness given in Hovland (2026) that he accepted to prepare for our set of papers. It is honor for us to host this important document for future science historians.

The discussion of the Hovland’s results later contributed to the implementation of the important study Gregori et al. (2025w), concerning an innovative formulation of basic axiomatic theoretical physics, aimed to avoid all paradoxes that, since over a century, bias present physics. Gregori et al. (2025w), however, is a paper that looks very difficult to

⁶ Not to be confused with aforementioned *variation principles* (Gregori et al., 2025e).

read. Thus, Gregori and Gregori (2025) is an attempt to give an epistemological/popular presentation of these arguments, while trying, as far as possible, to avoid using mathematical formulas, and to focus on mere epistemological aspects. This 306-page account is certainly much easier to read than the original paper Gregori et al. (2025w).

Geophysical applications

We mention several applications to specific geophysical phenomena, which are directly related to air-earth currents. On the other hand, it is impossible to give an exhaustive review of several topics, every one of which is the object of a very large number of investigations, and of published papers.

Earthquakes

Concerning some papers dealing with earthquake investigations, we recall Wu (2025) and Straser et al. (2026), Cataldi et al. (2025), Cataldi and Cataldi (2025), Straser (2025), Straser et al. (2025, 2025a, 2025b, 2025c, 2025d, 2025e), Wright and Leybourne (2025), and references therein. The topic is extremely varied and wide, and cannot be here remembered by short statements.

Wildfires

Wildfires are caused by three concurrent causes:

- (i) dry leaves, bushes and undergrowth,
- (ii) soil exhalation of CH_4 , and
- (iii) some tiny sparks that trigger fire, and that always exist.

That is, soil exhalation, which is one manifestation of air-earth currents, is a crucial ingredient for wildfire generation. Therefore, wildfire mapping on the planetary scale is a reliable proxy of the distribution in space and time of soil exhalation.

NASA's Earth Observatory contains monthly maps of wildfires on the globe. These maps are put together in a movie, one frame every month, and this movie looks extremely interesting. In particular, a cyclic feature is surprising due to its clarity and regularity, because the cycle is identically repeated several times. This is extensively reported and discussed by Gregori and Leybourne (2025i) and is here briefly recalled.

An excess amount of soil exhalation is observed to start from the Banda Sea, which – according to B. A. Leybourne – is the likely mysterious trigger of *ENSO*. Excess soil exhalation enters the Indochina Peninsula, where an increase occurs of wildfire density. A wave of crustal stress is clearly envisaged, mapped by the density of wildfire.

After propagating northward along the Indochina peninsula, the wildfire density bifurcates.

One branch moves along the eastern coast of China until reaching an area slightly north of Beijing, where an abrupt “flash” appears of dense wildfires. Then, the propagation of observed wildfires – i.e. of crustal stress - stops.

The other branch moves westward, partly through Myanmar and Bangladesh, and partly, maybe, along the Himalayas, where the soil ice-cover forbids the occurrence of wildfires. However, it ends up with an abrupt “flash” similar to - but even more evident than - the “flash” of the first branch. This second “flash” occurs somewhere in some area roughly around the Karakoram region.

It is impressive how this cycle is observed regularly and repeatedly several times. Hence, it is cannot be a matter of coincidence. The three points - i.e., the southern tip of Indochina, the Karakoram “flash”, and the Beijing “flash” - are roughly located at the vertices of an equilateral triangle (possible Delta circuit ?) of size $\sim 4,000 \text{ km}$. A microcrack, which propagates by “domino effect” (Gregori, 2013a) at a speed of $\sim 10 \text{ cm sec}^{-1}$, spends $\sim 4 \times 10^8 / 10 = 4 \times 10^7 \text{ sec} \approx 1.27 \text{ years}$ to run a $\sim 4,000 \text{ km}$ distance through the serpentosphere. Therefore, $\sim 1.3 \text{ years} \approx 16 \text{ months}$ is an excessively long time-delay in order to explain the observed “double flash” cyclic feature of wildfires.

Consider, however, that the Earth is a “sensor” suited to monitor - by means of wildfires - the discharges that occur only during some given season. Therefore, maybe, an overlapping occurs of two cyclic phenomena, one with $\sim 16 \text{ months}$ period, the other with $\sim 12 \text{ months}$. Hence, we should expect to monitor the beat between the two cycles, i.e., we should detect cyclic features of period $\sim 4 \text{ months}$ and $\sim 28 \text{ months}$, respectively.

The $\sim 4 \text{ months}$ cycle seems to be consistent with the “double flash” feature, while the $\sim 28 \text{ months}$ recurrence ought to require a longer observational database for being detectable.

However, compared to the aforementioned evidence perceived while watching the *NASA's Earth Observatory* wildfire movie, a time lag of $\sim 4 \text{ months}$ is too short, while $\sim 28 \text{ months}$ is too long. On the other hand, consider that these estimates hold only in terms of orders of magnitude. More accurate values ought to require a more specific monitoring both (i) of crustal stress propagation by acoustic emission (AE) arrays, and (ii) of timing of wildfire occurrence, upon also considering the local environment, which is eventually more or less suited to “detect” soil exhalation etc.

There is a need to explain the very narrow pattern of each “flash”. The lithospheric slab, which contains Indochina, slides northward on the slope of the geotumor, uplifted by the Banda Sea.⁷ It seemingly experiences two

depending what part you are looking. According to surge tectonics, the Banda Sea can be analyzed as a mantle and asthenosphere vortex with (counterflow) stream-flow processes, i.e., geostreams (see Leybourne and Adams, 2020).

⁷ Banda Sea has trenches such as the Weber Deep, not necessarily indicating uplift everywhere. All Earth's vortices in the mantle and asthenosphere have movements in opposite directions like hurricanes and tornadoes, and have down-drafts and updrafts

hinges - or holding points - of comparatively greater strength, where a great amount of friction is released (much like Etna is tentatively speculated to be the security valve for the friction released at the "hinge" between Africa and Eurasia; see Gregori and Leybourne, 2021).

That is, each "*flash*" can be imagined to be associated with the presence of a holding obstacle opposing the drift of this lithospheric slab beginning in Indochina.

According to the evidence of the Tang Maocang school, the Tibet Plateau is a region of anomalous large heat flow (see Gregori et al., 2025h), and this fact is consistent with the present hypothesis. Karakoram is, maybe, the best-known high plateau - which is almost inaccessible except by mountaineering expeditions with special equipment. That is, Karakoram is a topographically very elevated anomaly, which is probably permanently uplifting in order to compensate weathering.

Concerning the Beijing region, it is a well-known area of particularly great seismic hazard, in terms of large-magnitude shocks, which can occur only if the tectonic structures can accumulate a great amount of potential energy, i.e., if they are composed of structures that strongly hold while experiencing a comparatively lesser yearly deformation.

Summarizing, confirmation of this "model" - which at present is clear although merely speculative - can derive either from the detection of the *~28 months* cycle, or by monitoring crustal stress propagation by means of an array of *AE* recorders, or by the knowledge of the sea-urchin spike distribution.

For the time being, this hypothesis must be considered like an *ad hoc* speculation. On the other hand, to our knowledge, no alternative hypothesis is available to explain this clear observational feature. In principle "all" possible hypotheses ought to be suitably considered, whenever they are eventually available, and observations should then be considered in order to discriminate between different models.

Gregori and Leybourne (2025i) carried out also some statistical analysis of this curious cyclic feature.

Geomagnetic anomalies and volcanic plumes

Geomagnetic anomalies and volcanic plumes are an interesting evidence related to air-earth currents.

Geomagnetic anomalies display curious red/blue (i.e., positive/negative) alignments over the planetary scale. This feature is discussed in some detail by Gregori et al. (2025r), which discusses also the very common double-eye feature of geomagnetic anomalies observed in every volcanic area. This feature clearly envisages the sea-urchin spike supply to volcanoes.

Gregori et al. (2025t) focus on lightning and volcanic plumes. Lightning related to volcanic plumes are of three types:

- (i) *electron discharge* between the outer boundary of the volcanic plume and the ionosphere;
- (ii) *positive discharges* between plume boundary and soil, and

- (iii) the deadly *time-delayed discharges* between volcanic plume and soil.

This unprecedented model is supported by measurements of the electrostatic fall from a volcanic plume. A glorious precursory investigation was carried out by Luigi Palmieri (1807-1896), the second historical famous Director of the *Osservatorio Vesuviano*, in charge from December 1854 until his death. His investigations were later forgotten.

In contrast, the current interpretation of volcanic plumes gives no account for the precursory Palmieri's investigations. The entire topic is here reset, with reference to a specific discussion mainly of the Surtsey eruption in 1963-1964 that was carefully investigated also by records of atmospheric electric field.

Several additional case histories are also discussed. A mention is given about volcanic rings, as they are closely related to the Cowling dynamo mechanism (Gregori et al., 2026d), which is a leading anthem in the present entire set of papers on air-earth currents.

Craters, hurricanes and typhoons, lavakas

Craters are not always circular. Rather, they often display a polygonal geometry that reminds about a formation controlled by huge electrical discharges (Gregori et al., 2025u).

A specific concern deals with the relation between the Chicxulub crater and hurricanes. In addition, the lavakas - which are frequent in Madagascar - can be seemingly associated with the terminal of the typhoons that cross through the Indian Ocean.

Let us first recall about the hurricanes (Gregori et al., 2025j). The tropical storms begin in the Horn of Africa and move westward, while charging with water vapor and accumulating energy from the warm waters of the Atlantic Ocean.

Sometimes, although not rarely, when a tropical storm crosses over the Gulf of Mexico, the sea surface temperature (*SST*) abruptly, and mysteriously, increases in a very short time (maybe on less than a few hours). The anomalous *SST* supplies the tropical storm and transforms it into a deadly hurricane. The energy involved in this phenomenon is the *largest amount observed in any catastrophe*, much more than the most violent volcanic eruptions or earthquakes.

Gregori et al. (2025j) investigate the possibility that the cause of the abrupt *SST* increase is an abrupt release of endogenous energy associated with a remnant of the former precipitation of the Chicxulub crater. The conclusion looks realistic, even though additional hard thinking and investigations are needed.

Our proposed explanation is according to the following mechanism. The former large Chicxulub astrobleme produced a wound in the Earth, causing a large increase of the electrical conductivity of deep Earth layers, thus permitting the formation of a huge bunch of sea-urchin spikes. Subsequently, the *j* currents, originated by the *TD*

dynamo, maintained this feature, which thus became a permanent characteristic of deep Earth. Today this feature seems to be the possible hinge around which South America is rotating clockwise (Gregori and Leybourne, 2021).

Similarly, the mysterious case history of the Madagascar lavakas is related (i) to the peculiar and unusual geometry of every lavaka, and (ii) to the peculiar space distribution and clustering of lavakas. See Gregori et al. (2025v).

It seems that the typhoons - that cross through the Indian Ocean - end their track over Madagascar, where they cause a large electrical discharge. The electrical discharge is caused by a coupling with the anomalous density of underground sea-urchin spikes. The electrical discharge displays therefore a peculiar polygonal geometry, related to a gentle slope of soil. The observational evidence seems to confirm this guess, seemingly suited for this otherwise unexplained peculiar and clear phenomenon.

Planetary extreme discharges

An even more difficult hypothesis considers the possibility that huge planetary-scale arc-blast discharges determine anomalous, and yet unrecognized, geological features.

This possibility is extensively discussed by Leybourne et al. (2025), who envisage a pattern that they call “*Stellar Transformer*”. See also Leybourne et al. (2025a) and references therein.

A somewhat less general, although somewhat similar, perspective is considered by Gregori et al. (2025x). We do not report details here. The interested reader should refer to the aforementioned papers and references therein.

Climate, and the exploitation of energy

Two last items deal

- (i) with the implications for the global climate change perspective, including a discussion of glaciers proxy, and
- (ii) with the exploitation of the electrostatic energy of the atmosphere.

Gregori and Leybourne (2025k) address the climate topic and conclude with the unreliability of glacier proxies.

Gregori and Leybourne (2025l) discuss the possibilities to exploit the electrostatic energy of the atmosphere, which is an unbelievable huge and widespread reservoir of free energy. No detail is here given.

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G. P. Gregori has been retired since 2005. B.A. Leybourne is a semi-retired self-funded independent researcher.

Author’s Contributions

This study derived from a long-lasting cooperation by both authors. The backbone draft was mainly prepared by the first author, although many ideas resulted from the emergence of long-lasting discussions between the authors.

Ethics

This article is original and contains unpublished material. Authors declare that there are no ethical issues and no conflict of interest that may arise after the publication of this manuscript.

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- e.m. - electromagnetic
e.m.f. – eletro-motive force
ESA - European Space Agency
FAC - field-aligned current
GK - Gurevich and Karashtin (effect)
IAGA – International Association for Geomagnetism and Aeronomy
IC - inner core
ICB – inner core boundary
IFA - Institute for the Physics of the Atmosphere (a CNR institute)
IGRF - International Geomagnetic Reference Field
IMF - interplanetary magnetic field CME - Coronal Mass Ejection
magpol - magnetic polarization (a state of matter)
NASA – National Aeronautic and Space Administration
OC - outer core
RB - runaway breakdown
SST - sea surface temperature
SV - secular variation
CHAMP - ESA satellite to study the Earth's magnetic field
TGF - terrestrial gamma flash
TLE - transient luminous phenomenon

Acronyms

- AE – acoustic emission
ALB – asthenosphere-lithosphere boundary
BL - ball lighting
CMB – core-mantle boundary
CNR – *Consiglio Nazionale delle Ricerche* (Italy)

ABOUT THE NCGT JOURNAL

The NCGT Newsletter, the predecessor of the NCGT Journal, was begun as a result of discussions at the symposium “Alternative Theories to Plate Tectonics” held at the 30th International Geological Congress in Beijing in August 1996. The name is taken from an earlier symposium held in association with the 28th International Geological Congress in Washington, D. C. in 1989. The first issue of the NCGT Newsletter was December 1996. The NCGT Newsletter changed its name in 2013 to the NCGT Journal. Aims of the NCGT Journal include:

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2. Forming an organizational focus for creative ideas not fitting readily within the scope of dominant tectonic models.
3. Forming the basis for the reproduction and publication of such work, especially where there has been censorship or discrimination.

