EYE ON SCIENCE

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THE WONDERS OF SCIENCE

EARTH SCIENCES

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IN THIS ISSUE...

Earth: Answers and More Questions

By: Maissa Azab

Earth, our unique blue planet, is the only world that we know of to host life of endless variety. Over millennia, the curiosity of Man has led him to unravel numerous secrets of the enormous universe; yet, we have only scratched the surface and we are yet to discover life somewhere else in its vastness. On the other hand, our knowledge of our own planet has expanded exponentially; yet, it seems the more we know about it, the more fascinating it becomes.

This year, marking the tenth since the launch of this periodic publication, first as a Newsletter of the Bibliotheca Alexandrina Planetarium Science Center, then as Egypt's first popular science magazine, we are returning to the wonders of natural sciences as our overarching annual theme. After delving into astronomical and space sciences in our latest issue, we turn our attention in this issue to Earth Sciences.

Our articles tackle a variety of aspects relating to the Earth's structure, its climate and the ongoing and pressing issue of climate change, its amazing biodiversity and its enthralling revelations. As usual, we also discuss noteworthy figures that have contributed significantly to our knowledge of Earth; we also look into some cultural aspects relating to *Earth Sciences*, including articles by our esteemed contributors from the Cultural Outreach Sector: Dr. Tarek Elawadi, Dr. Omar Fikry, and Dr. Shaymaa Elsherif.

We trust you will find this newest issue of our "Wonders of Science" series intriguing and informative; it will hopefully incite your interest to read more about *Earth Sciences* and more in *SCIplanet* online, where, in addition to our newest articles, you can also read articles from our earlier issues, the subjects of which are still very much relevant.

As always, we hope you enjoy your read, and we look forward to your reviews, comments, and/or suggestions at PSCeditors@bibalex.org.

10 YEARS OF SUCCESS

"With *SCIplanet*, learning is no longer spoon-fed; it is rather presented in a delicious piece of candy that enlightens your mind and makes you enjoy every piece of it as it dissolves. *SCIplanet*: science is sweet"

Dr. Shaymaa Elsherif, In Charge of Cultural Programs and Activities, BA Center for Francophone Activities

"I am delighted to see the great variety of articles in this fine magazine; the treasures of knowledge they convey are a testament to the basic role of the BA in spreading knowledge in the best possible form. Thanks for a job well-done; I am proud of you all."

Dr. Farouk El-Baz, Research Professor and the Director of the Center for Remote Sensing at Boston University

"2017 marks *SCIplanet* tenth anniversary. The Planetarium Science Center is proud to celebrate with the publications' team the fruits of this unique initiative. It has been a long way of hard work that resulted in a completely in-house production of a world-class science magazine yet "Made in the Bibliotheca Alexandrina.""

Eng. Ayman El Sayed, Director of the BA Planetarium Science Center

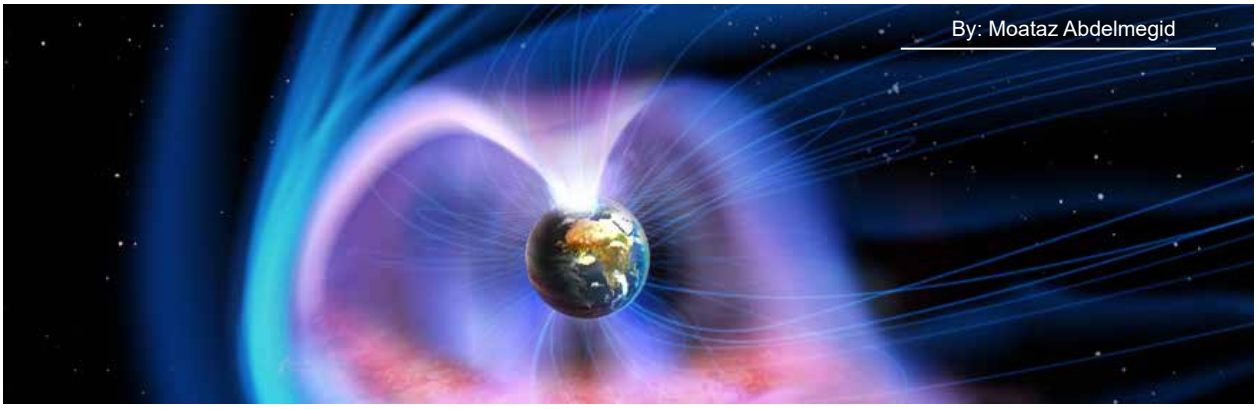
"Believing in this project is the secret of its excellence; if you do not believe in the importance of scientific reading and writing, you will never reach this fineness that *SCIplanet* has reached. Of course, I am proud of my contributions along with this outstanding team. Congratulations to all the team for ten years of distinction and creativity."

Dr. Omar Fikry, Head of the BA Planetarium Section

"It has been a lengthy, but inspiring journey; it has been a tremendous challenge, yet infused with passion and conviction. Observation, training, hard work, constant listening, and ongoing reevaluation have been the means by which our then small team of three overcame all obstacles and dilemmas encountered along the path, till we succeeded, over and over again, from one issue to the next, and from one year to the following. The team has since grown, and with its evolution the desire has also grown for further success and to exceed all previous successes in every new issue and through every possible medium. Now, as we stand at the threshold of a new decade of arduous, yet thrilling work, I can confidently declare that, where there is will, faith in the mission, and passion for the work, all within a cohesive team dedicated to a unified goal, then there is no doubt in the success. It is all ever the more amazing that this awesome team, of which I am the proudest, comes together to popularize scientific culture through edutainment within the Egyptian community."

Ms. Maissa Azab, Editor In-Chief of *SCIplanet*

Mysteries of the MAGNETOSPHERE



By: Moataz Abdelmegid

The magnetosphere is the region of magnetic influence of a celestial body; the nature of this region varies depending on the size of the body and the intensity of the magnetic field it generates. Most planets in the solar system have this magnetic protection layer, with the exception of Venus and Mars; icy moons are examples of bodies that lack a magnetosphere. This magnetic layer is created through electric currents flowing in space and is in a constant state of change, even flipping its orientation every few thousand years.

The Earth's magnetosphere is defined by its internal magnetic field, solar wind plasma, and Interplanetary Magnetic Field (IMF). When this mix of free ions and electrons, from both the solar wind and the Earth's ionosphere, become confined by magnetic and electric forces much stronger than gravity, a bullet shaped effect is created, which radiates out approximately 36,000 miles (approx. 57,936 km). Earth's magnetosphere shields us from a wide range of the energy particles received from cosmic waves; the higher layer of the atmosphere intercepts energetic particles and circulates them throughout the magnetosphere. These trapped particles are responsible for natural phenomena, such as the aurora and natural radio emissions.

The Earth's magnetic field almost resembles a magnetic dipole, with one pole near the North Pole and the other near the geographic South Pole. An imaginary line joining the magnetic poles would be inclined by approximately 11.3° from the planet's axis of rotation. There is no complete understanding of how Earth's magnetic field was formed, but its origin is believed to be associated with electrical currents produced by the coupling of convective effects and rotation in the spinning liquid metallic outer core of iron and nickel. It follows the same mechanism as what is referred to as "the dynamo effect"; the direction of Earth's magnetic field attributed to a dynamo effect is not constantly changing.

In physics, all magnets have two poles that are distinguished by the direction of the magnetic flux. In principle these poles could be labelled in any way; for example, as "positive and negative" or "north and south". Based on the early use of magnets in compasses they were named the "North Pole" or "North-seeking Pole" (N); and the "South Pole" or "South-seeking Pole" (S), with the North Pole pointing North; that is, the one attracted to the Earth's North Magnetic Pole. As opposite Poles attract, the Earth's North Magnetic Pole is, by this definition, physically a magnetic South Pole; conversely, the Earth's South Magnetic Pole is physically a magnetic North Pole.

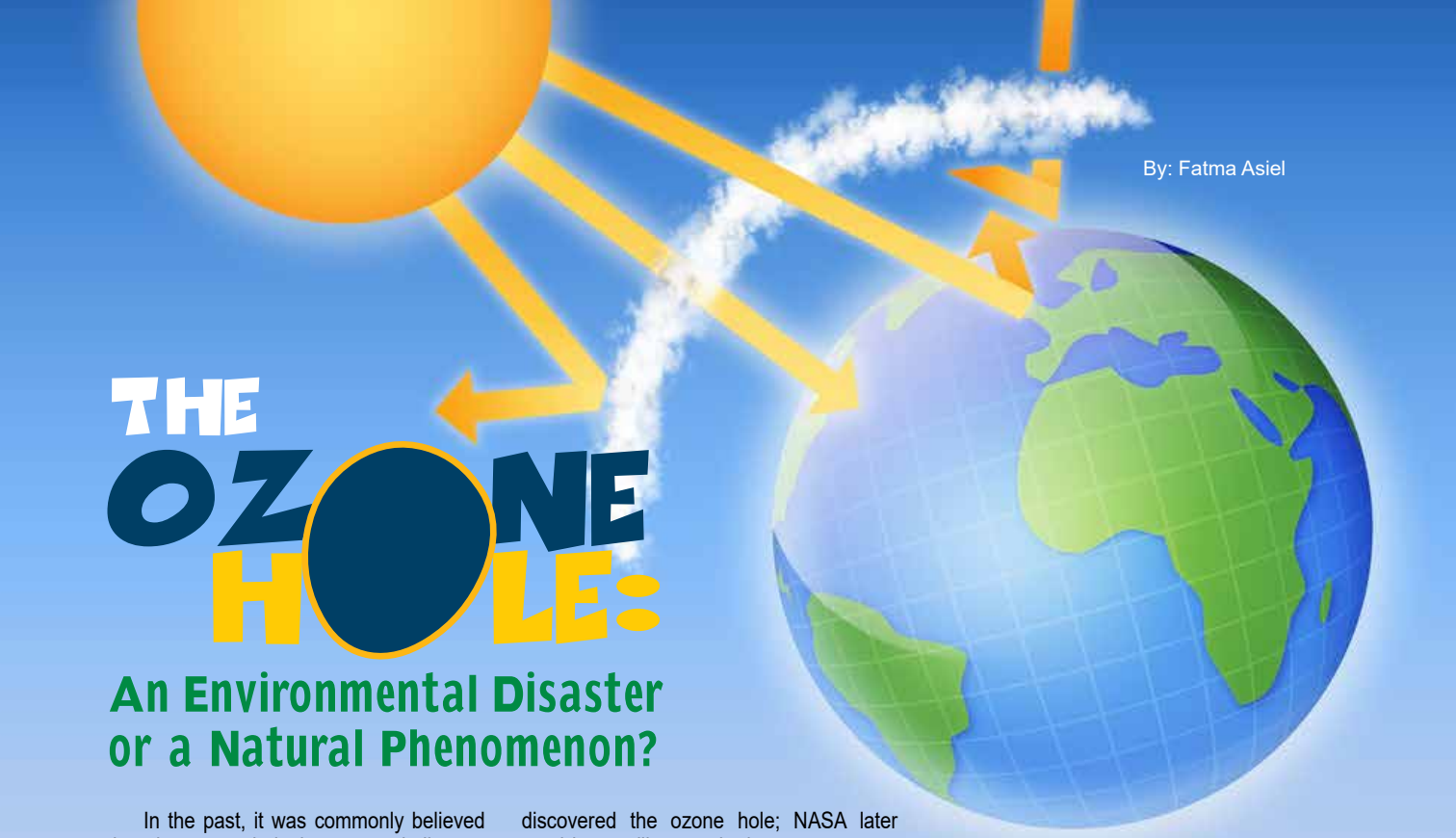
Inside the magnetosphere, there is the plasmasphere; a donut-shaped region containing low-energy charged particles, or plasma. This region begins at a height of 60 km, extends up to 3–4 Earth radii, and includes the ionosphere; this region rotates with Earth. There are also two concentric tire-shaped regions, known as the Van Allen radiation belts, with high-energy ions—energies 0.1–10 million electron-Volts (MeV). The inner belt is 1–2 Earth radii out, while the outer belt is at 4–7 Earth radii. The plasmasphere and Van Allen belts have partial overlap, with the extent of overlap varying greatly with solar activity.

The Earth's magnetic field is different from the magnetic field of a bar magnet. In the case of a bar magnet, or any other type of permanent magnet, the field is created by the coordinated motions of electrons within iron atoms. However, the Earth's magnetic field is not due to magnetized iron deposits, but mostly by electric currents in the liquid outer core; electric currents induced in the ionosphere also generate magnetic fields. Such a field is always generated near where the atmosphere is closest to the Sun, leading to daily alterations that can deflect surface magnetic fields by as much as one degree.

There is a number of scientific theories suggesting that the magnetic field is generated by Earth's molten core, defending our planet against devastating solar winds, affects everything on Earth's surface, from global communication to animal migration and weather patterns. There is also scientific evidence pointing out that the magnetosphere was weakened by 15% over the past 200 years, and this, according to scientists' claims, could be a sign that the Earth's Poles are about to flip! Over the years, scientists noticed that the Earth has flipped its polarity many times; yet, there is no indication that the Earth's magnetic field has ever disappeared.

References

nasa-usa.de
tokenrock.com
solarphysics.livingreviews.org



THE OZONE HOLE:

An Environmental Disaster or a Natural Phenomenon?

By: Fatma Asiel

In the past, it was commonly believed that the ozone hole is a natural disaster caused by exhaust, fumes, and other environmental pollutants. Thus, scientists have predicted an imminent environmental catastrophe within a few years that would result in the destruction of the protective layer that shields Earth from harmful Sun radiations. However, a recently-emerging theory completely rejects the notion; instead, it confirms the existence of this hole for a long time, claiming it is a natural phenomenon that is not cause for concern. To present the two theories with proof and evidence, there are some facts that we need to understand about the ozone layer.

First, we need to comprehend that there is a difference between ozone gas and the ozone layer. Ozone is a poisonous blue gas composed of three oxygen atoms with the chemical symbol O_3; it is used for medical purposes and in sterilization. The ozone shield is a protective layer composed of ozone gas; it is located in the stratosphere, the second layer of the atmosphere, approximately 25–30 km above the Earth's surface. The main function of the ozone layer is shielding the Earth's surface and living organisms from harmful Sun radiations, particularly Ultraviolet (UV) radiations. These harmful radiations cause blindness and skin cancer, kill some living organisms, and cause other environmental disasters.

In 1985, Britain sent an exploratory team to the South Pole; during the expedition, one scientist observed that the ozone level in this region was lower than in others. After several experiments and tests, scientist discovered the ozone hole; NASA later used its satellites to obtain more accurate information. The surprise was that the entire South Pole region suffers from ozone level depletion; another smaller hole was discovered in the North Pole. By monitoring the ozone hole, scientists noticed that the hole expands from September to December annually, and shrinks the rest of year.

When the ozone hole was discovered, scientists predicted an impending disaster; the serious expansion of the hole in the Earth's shield protecting it from the Sun's harmful rays, sooner or later, could kill all living organisms. Scientists have made great efforts researching the causes of this hole; after several studies and experiments, they have concluded that there are several factors, including:

- The emissions of Chlorofluorocarbons (CFCs), which are organic compounds, containing chlorine, carbon, and fluorine; they are known commercially as Freon, which is used in refrigerators and air conditioners.
- Exhaust fumes from cars and airplanes, factory smoke, and chemical wastes responsible for air pollution.

Given these causes, we find that most of them are emitted from vital and important resources of human life; thus, they were uncontainable. The only solution became limiting the use of these sources as much as possible, and trying to find clean alternatives, such as solar energy, wind power, and others.

Some scientists are inclined towards a completely different theory though; namely, that the ozone hole is a natural phenomenon that transpired since the formation of the ozone layer. As such, the ozone hole is harmless to living organisms and does not expand continuously; the scientists based their theory on several scientific and logical reasons, including:

- The ozone layer cannot be destroyed, but is renewed by the continuous formation of new ozone molecules.
- The existence of the ozone hole in the North Pole and South Pole; two of the least polluted regions in the world.
- The hole appears during a certain period of the year, specifically during the Polar spring, and then decreases gradually until it disappears totally during the Polar winter.
- Chlorine atoms, most of the exhausts, and Freon gas do not reach the upper atmosphere layers, but remain in its lower layers.
- Statistics conducted on skin cancer cases in the North Pole and South Pole, and other regions worldwide where the ozone layer is of great thickness indicate close results.

Given these logical arguments, we may say that the ozone hole is a natural phenomenon that is not cause for concern. However, we are not quite sure of this; there are several ongoing researches and studies to make sure the hole does not represent any danger to life.

References

nstarzone.com
theozonehole.com

Climate Observations based on ALLATRA SCIENCE

By: Dr. Valery Vershigora,
ALLATRA SCIENCE
Working Group Member

Global climate change is one of the most important international problems of the 21st century. The overall rapid increase in the dynamics of cataclysms[1], which have been observed in recent decades, is particularly alarming. Today, there is a big risk of misunderstanding and underestimating all the factors and the scale of influence of various cosmic and geological processes on global climate change.

At the end of the 20th century, some scientists put forward various hypotheses and theories about gradual climate change; however, in practice, everything turned out to be somewhat different. A thorough analysis of the growing number of natural disasters and extreme weather events around the world, as well as statistical factors of cosmic and geophysical parameters in recent years, has shown a disturbing tendency towards their significant increase over a short period of time. This data indicates that the assumptions that were put forward about the gradual nature of climate change of Earth within 100 years and more are incorrect; in fact, this process is much more dynamic.

The inaccuracy was that many scientists of the past years did not take into consideration the influence of the increasing acceleration of the Universe, cosmic factors, and astronomical processes on the condition of the global climatic system. All this, naturally, is affecting not only the Sun, but also the other planets of the Solar System, including such a giant planet as Jupiter, not to mention our planet. Global climate change on Earth is mostly a derivative of astronomical processes and their cyclicity; cyclicity being inevitable. The geological history of our planet indicates that Earth has already repeatedly experienced such phases of global climate change.

If scientists of the past made their conclusions based on research and observations with limited technical means and resources of the time, today, the scientific range of possibilities has become much wider. The latest research in the field of elementary particles physics and neutrino astrophysics, conducted by a working team of scientists at the ALLATRA International Public Movement[2], offers increased opportunities for advanced fundamental and applied research.

History has taught us that lack of unification of human society on moral basis and joint actions of people on the planet, continent, and region, regarding preparations for large-scale cataclysms and disasters result in the destruction of most of these people. Only advance preparation and unity of the peoples of the world before impending natural danger gives mankind more chances of survival and the possibility to jointly overcome the difficulties in the era of global climate change of the planet.

Results of Observations of Septon[3] Activity

On 11 March 2011, in Japan, the "Great Eastern Earthquake" of a 9.0 magnitude occurred; it was the most powerful earthquake for the entire period of seismic observations in this country. The epicenter of the seismic activity was located 130 km from the city of Sendai, so the authorities had little time to warn and somehow protect the population from the approaching tsunami, because it was impossible to prevent anything. In other words, the exact time and place of the tragedy became known to the Japanese experts and authorities, in fact, a mere 11 minutes before it started.

However, today, the development of theoretical and applied PRIMORDIAL ALLATRA PHYSICS, which forms a fundamentally new understanding of physical processes and phenomena occurring in animate and inanimate nature, gives mankind a chance for an evolutionary breakthrough in various fields of science, since everything in this world is based on physics. This also applies to the area of a more detailed study of geophysics.

Based on the general laws of the PRIMORDIAL ALLATRA PHYSICS, calculations can be made, which, in the near future, will allow not only to predict the course of the physical processes and phenomena, but also to accurately calculate nature's behavior. Hence, measures can

be taken in advance for a full or partial preparation, or at least mitigation of one or another natural phenomenon, or, as a last resort, for evacuation of the population in advance.

There are solid grounds behind statements that modern theoretical physics is currently in crisis. For about 100 years, there have been no serious evolutional breakthroughs since the late 19th and early 20th centuries when elementary particles were discovered. To this day, scientific research, calculations, and developments are still based on them. Starting from the 1950s, accelerators have been the major instrument for studying elementary particles in physics, while the subject of research became new elementary particles emerging from the collision with the substance of accelerated protons and electrons.

However, despite the variety of discovered particles, world scientific luminaries have not yet answered the fundamental questions of physics: What are the fundamental principles of matter? How did it appear, and where does it disappear to? Everything revolves around accelerators; increase in frequency, power, and variations of particle collisions. This points to the fact that there is not enough knowledge to operate with accurate information instead of predicting and guessing, including about complex climatic processes.

Climatic Engineering

New developments in the field of climatic engineering offer great opportunities and prospects for further scientific activity in this direction. They make it possible to monitor climate, determine the course of events related to climate change based on multifactor analysis, identify compensatory mechanisms of nature, and launch relevant local or general actions aimed at changing climate conditions. The latest developments of ALLATRA scientific group in this field make it possible already today to identify quite accurately the "focal" or the so-called "problem area" on the planet, which will trigger irreversible changes in the near future.

The conducted research identified an extremely alarming fact. Judging by the graphs of neutrino emission and the intensity of the septon field of the Earth, there is a close parallelism between the processes taking place in the most Ancient calderas—Aira Caldera (Kagoshima Prefecture, Kyushu region, Japan) and Yellowstone Caldera (Wyoming, USA)—despite the fact that they are separated by the Pacific Plate. This fact is extremely alarming because it indicates that the processes occurring in the Earth's interior are becoming irreversible.

A group of scientists of ALLATRA International Public Movement discovered another unusual phenomenon related to the change in the intensity of the septon field of the Earth. They identified a previously unknown fact that takes place prior to a natural disaster; literally 7–8 hours before a tornado occurs, there is a sharp increase in the septon field intensity in the places of its origin and along its further route.

The PRIMORDIAL ALLATRA PHYSICS contains basic information about the elementary principles of physics of fundamental particles, regardless of their interaction. This knowledge affects the full spectrum of fundamental and interdisciplinary research in various areas of science from microphysics to cosmology; it reveals unique information about fundamental principles of neutrino physics and astrophysics of elementary particles.

How do modern scientists predict the occurrence of certain events? In meteorology, unusually powerful cumulonimbus clouds are one of the main conditions for the emergence of a tornado. The former, in their turn, are formed during the invasion of cold air on the overheated land surface. The satellite captures the cloud front, and based on these pictures, scientists make assumptions about the possibility of occurrence of the respective natural phenomena. In fact, mankind visually observes and draws conclusions about the consequences of the physical phenomena, which have already taken place in the invisible world, so the conclusions of scientists are assumptions by their nature, rather than precise knowledge of the causes of the origin of these phenomena in the physics of microcosm.

In nature, there is a continuous process of movement and transformation of matter at different levels of its organization, at different speed, with different phase states, physical and other conditions, etc. Science has proven that, if the human eye cannot see these transformations, it does not mean that these processes do not exist. It is interesting that Man, as a biological creature, as a resident of the three-dimensional world, is substantially limited in his perception, and consequently, cognition, of the surrounding reality.

Glossary

(1) **Cataclysm** is a large-scale and violent event in the natural world.

(2) **ALLATRA International Public Movement** is an international association, whose members aspire to use their best qualities for the benefit of the society.

(3) **Septon** is a modern term used in the PRIMORDIAL ALLATRA PHYSICS. The word "septon" is derived from the Latin word "*septem*", which means seven; referring to the number of elements in this structure.

References

On the Problems and Consequences of Global Climate Change on Earth Report.
Olga Andreeva, *Renewable Energy Law and Policy Review Article.*
allatra-science.org
allatra.org/reports
intellihub.com

Portraying Earth

By: Maissa Azab

Our fascination and curiosity about the world we inhabit is inherent in our human nature; it is why we have always endeavored to depict Earth and illustrate its features. Cartography is, hence, the art and science of graphically representing geographical areas, usually on a flat surface such as a map or chart; the difference being that maps apply to land and charts are for marine areas. It is a complex, ever-changing field; the process includes everything from the gathering, evaluation, and processing of source data, through the intellectual and graphical design of the map, to the drawing and reproduction of the final document. Thus, it is a unique mixture of science, art, and technology; it calls for a variety of in-depth knowledge and skills on the part of cartographers.

Maps perform a fundamental and indispensable role as one of the keystones of civilization; few activities relating to the Earth's surface would be practicable without maps. Cartography has, thus, been inextricably tied to geography for most of its history; however, since the 20th century, it has diversified thanks to an increasingly digital modern world. Nevertheless, despite the advent of Geographic Information Systems (GIS), the two disciplines do not compete with each other, but rather complement each other through a cross-disciplinary approach.

Cartography is an ancient discipline that dates back to prehistoric depictions of hunting and fishing territories. Mapping in early civilizations, such as Mesopotamia and Egypt, were linked to astronomy and what we then knew about the stars, geometry, and surveying. Surveying permitted the building of huge monuments, to plot how much land people owned and charge them taxes.

The discipline seemed to change little until the era of Greek civilization, which helped develop enormously the understanding of cartography as an important science for the society in general. They performed deep study of the size and shape of the Earth and its habitable areas, climatic zones, and country positions. Anaximander, for instance, was the first to draw a map of the known world; while Pythagoras of Samos speculated about the notion of a spherical Earth with a central fire at its core. Eratosthenes, already in the 3rd century BCE, contributed greatly to the history of geographic knowledge and the world map; unfortunately, we only have indirect references to this work through other authors such as Strabo from Elea, whose work is far better known in our time.

During Roman times, cartographers focused on practical uses; military and administrative needs to control the Empire economically and politically. Roman maps were more or less restricted to the area comprised by what they called Mare Nostrum, which was the core of the Roman Empire and around which all the administrative regions were distributed. The pinnacle of cartography during the Roman Empire was the map of the Roman world produced by Claudius Ptolemaeus, also known as Ptolemy.

The Babylonians mapped the world in a flattened, disk-shaped form, but Ptolemy established the basis for subsequent efforts in the 2nd century with his eight-volume *Geōgraphikē hyphēgēsis (Guide to Geography)*, which showed a spherical Earth. Ptolemy's *Guide to Geography* would remain the primary authority in Europe for the following 1400 years. Great strides were made in China and the Islamic world; the reasons for compiling maps often the same as in Europe. That is, for political purposes, to show the country or people in relation to the rest of the world, or predominance in relation to religious centers.

Muslim scholars continued and advanced on the traditional map-making of earlier cultures; they also started using the knowledge, notes, and writings of explorers and merchants from their travels across the Muslim world. There were advances in

a more accurate definition of the measure units, in addition great efforts in attempting to describe and define the calculations of the circumference of the Earth. There were also numerous studies and methodologies to draw a system of meridians and parallels that helped greatly in the evolution of the science of cartography, as those created by Ibn Battuta or Al-Idrisi.

Tabula Rogeriana by Al-Idrisi is not just a map of the world, it is an extensively researched geographical text that covers natural features, ethnic and cultural groups, socioeconomic structures, and other characteristics of every area he mapped. This work was created for King Roger II of Sicily; Al-Idrisi drew upon his own extensive travels, interviews with explorers, and draftsmen paid to travel and map their routes. These maps describe the world as a sphere, and break it up into seventy different rectangular sections, each of which is discussed in exacting detail in the remainder of the Tabula.

Maps produced during the Middle Ages followed Ptolemy's guide, but they used Jerusalem as the central feature and placed East at the top. Those representations are often named T-maps, because they show only three continents—Europe, Asia, and Africa—separated by the "T" formed by the Mediterranean Sea and the Nile River.

The *Hereford Mappa Mundi* is notable for being the largest Medieval map still in existence, as well as one of the most elaborately drawn and colored. One odd feature of the *Hereford Map* is that Europe is mislabeled as Africa, and vice versa. Though the Map is circular, experts do not think it is evidence that the cartographer believed in a flat Earth. Instead, the *Hereford Mappa Mundi* is widely regarded as being a type of projection, with the uninhabitable regions to the North and South omitted from the Map.

In 1579, China was the first country to develop a grid system to plot maps, and these were highly accurate compared to their contemporaries in Europe and the Islamic world. On the other hand, the discovery of the New World was a fierce battleground for the powers looking to claim as much of the land for themselves as they could; growing imperialism was as much about documenting claims to new lands as it was about making the physical claim on the ground.

A big advance in cartographic science came in 1569, with the publication of Mercator's first maps. His mapping techniques were improved later in 1570, when Abraham Ortelius published his *Theatrum Orbis Terrarum*, which for the first time, included maps based on the best available, purely contemporary information.

Gerardus Mercator's *Mercator Map* is notable for being the first attempt to make a spherical Earth look "correct" on a flat surface. The problem inherent in representing a spherical shape on a flat plane is that things tend to be distorted. Lines of latitude and longitude, useful for navigating a globe, become warped and useless on a flat map. Mercator sought to account for this by keeping the lines straight, and distorting the size of objects closest to the Poles; the result was the *Mercator projection*, an invaluable tool for navigation at sea. As the *Mercator projection* allowed for straight lines, named loxodromes, it was much easier for ship navigators to use to chart a course, despite the trade-off of distortion.

The printing press made the process of publishing maps easier than it had been before when every map had to be produced and reproduced by hand. During the 17th and 18th centuries, there was a vast outpouring of printed maps of ever-increasing accuracy and sophistication. Systematic surveys were undertaken involving triangulation that greatly improved map reliability and precision. Noteworthy among the scientific methods introduced later was the use of the telescope for determining the length of a degree of longitude.

Modern cartography as we would understand it today began in the late 18th century. Interestingly, the development of cartography as a science is less to do with study for study's sake, and more to do with warfare; topography has long been understood as an important aspect of infantry attacks and defense. Today, national organizations produce a variety of maps for different reasons and there is a much greater focus on accuracy and the transmittal of relevant information, depending on the type of map produced and the type of map needed.

At the beginning of the 20th century, aerial photography, and increasingly, satellite photographs changed the face of mapping once more. The procedures for translating photographic data into maps are governed by the principles of photogrammetry and yield a degree of accuracy previously unattainable. The remarkable improvements in satellite photography and the general availability on the Internet of satellite images have made possible the creation of Google Earth and other databases that are widely available online. Moreover, the use of GIS has been indispensable in expanding the scope of cartographic subjects.

Once seen as the products of a relatively straightforward practical exercise, maps are now viewed as complex intellectual images offering a rich potential for scientific investigation. Whether the thrust of the research is cognitive, mathematical, historical, perceptual, or technological, cartographers are exploiting this potential to the fullest.

References

britannica.com
cca-acc.org
environmentalscience.org
gislounge.com
theatlantic.com

By: Jailane Salem

GLACIOLOGY: A Brief Account

Ice comes in different forms: ice sheets, glaciers, sea ice, and frozen ground. It holds key information that can help us know about what the climate was like in the past and predict how it will change in the future. It preserves materials and chemicals that can be excavated and analyzed in labs, to provide us instrumental information.

One of the key areas where glaciologists, studying ice and glaciers, work is in the Earth's South Pole and North Pole, where they keep track of the movements of the ice, as well as dig deep using special equipment to retrieve the needed samples for analysis. Glaciers and ice sheets are quite large formations and can vary in thickness from one-hundred meters to over one-thousand meters. This ice developed over centuries and each year a layer is added on top, creating massive glaciers that can be seen on mountains.

One of the earlier pioneers of glaciology is Julius von Haast; born in Germany, in 1822, and joined the University of the Rhine to study geology and minerology, but he did not graduate.

He ended up travelling to New Zealand, which was still a colony at the time, in order to investigate the prospects of immigration for German colonials. While this was the purpose of his travels, once he arrived he ended up joining a scientific expedition on which he carried out a topographical and geological survey of the West Coast in 1859.

Haast went on many such explorations in New Zealand, including one to the glacier region near Mt. Cook, which inspired his book *The Geology of Canterbury and Westland* (1879). He was also great at sketching glaciers and mountain regions so that later on they have been used to compare and contrast what the glaciers look like now to how they used to look like in the 19th century. Haast recognized and studied the effects of past glaciation, made various observations on glaciers, and his geological studies were the basis for later work, laying the foundation for glaciology as a scientific field.

If we compare the sketches Haast took and the present state of the glaciers, differences are strongly apparent. Some of the glaciers that are melting and retreating in New Zealand have been at a previous point one of the main attractions for tourists visiting the country. Unfortunately, as of 2016, tour operators have limited tour groups due to the higher risk of trekking the glaciers in their current conditions. No longer can people approach the glacier on foot; they actually need to be flown in, and in the future it might become completely off limits due to how dangerous it is becoming.

The melting and retreat of glaciers has its consequences; the warmer the climate gets due to global warming, the faster the glaciers melt, leading to rising sea levels. Of course, this means that many low-lying lands will be at risk of being flooded and some places might even become completely submerged under water. The problem is when melted fresh water enters the ocean; while it not only increases sea levels, but it also alters the ocean water's composition. Salty sea water is heavier than fresh water, which means that salty sea water will be pushed down. This would cause the currents of the ocean to change, and consequently affect the surrounding climate, as well as the existing ecosystem.

Whilst these changes occur in water, the retreating white icy masses have another negative effect. The white surface of glaciers reflects the Sun rays, which helps regulate our climate, keeping it mild. However, as the ice melts, the darker surface on which it rested is exposed and these tend to absorb and release more heat, adding to the whole warming conundrum. This is why glaciology is so important; because through this field, we can gain a tangible understanding of our changing climate, and perhaps key in on important information that might help us better adapt to it.

References

earthweb.ess.washington.edu
extremeicesurvey.org
glacierhub.org
teara.govt.nz

By: Soha Elborgy

NEWSFLASH! Life Under Ice Does Not Take a WINTER BREAK

Roughly 50 million lakes freeze seasonally; it has always been understood that life under the cover of ice takes the winter season off. Sea-ice studies, however, have found that life under the ice, contrary to old beliefs, is very much active.

Previous researches studied the conditions of lakes in summer, but little is known about what happens under the icy cover of winter. With that, Stephanie Hampton, Director of the Center for Environmental Research at Washington University, began to collect and analyze data for the lake conditions in winter, which could then be compared to those in summer.

Hampton's team first reviewed existing research of under-ice and summer observations conducted between the years 1940 and 2015 from 100 lakes. The findings varied from one lake to another, based on the type of the ice cover and the level of Sun penetration. They have discovered that lakes do not sleep when covered with ice, but rather start a process of food formation for organisms to use during the summer season. Even with the winter's low temperatures, which slow life down, algae and zooplankton are still abundant, creating food sources for fish and other aquatic creatures after winter.

While studying Lake Baikal in Siberia, Russian researchers have discovered a microecosystem; much of the ice can provide habitat for microorganisms. This microecosystem can vary according to the clearness of the ice. Winter algae blooms are larger than summer blooms, especially when the ice is clear as it provides enough light for the algae that dominates the big winter blooms. However, thicker ice and snow blocks out the Sun and hinders growth. These findings show how winter is necessary for a healthy environment all year round.

As global temperatures rise, how will lake ecosystems respond? As they warm, will lakes—which make up only 3% of the landscape, but bury more carbon than the world's oceans combined—release more of the greenhouse gases carbon dioxide and methane?

Global warming poses many threats on the whole fresh water system. It adds to the stress of the lake system that is already struggling with aquatic invasive species, deleterious land use changes, nonpoint source pollution, toxic chemical contamination, and coastal habitat degradation/wetlands loss. Potential global warming impacts include reduced water levels, due in particular to decreased winter ice cover allowing more evaporation and warmer water temperatures.

The largest of the Great Lakes of North America, Lake Superior, for example, has increased water temperatures and an earlier onset of summer stratification by about two weeks in just the past 30 years. Within another 30 years, Lake Superior may be mostly ice-free in a typical winter. The water levels of Lake Erie, the fourth largest lake of the five Great Lakes, already below average, could drop 36.5–45.7 cm by the end of this century, significantly altering shoreline habitat.

Global warming could change internal water cycling in the Great Lakes with longer summers potentially leading to larger Dead Zones—low oxygen content—that could be problematic for the growth of algae, zooplankton, and other microorganisms. The Great Lakes, for instance, which constitute one-fifth of the world's fresh surface water, are warming at rates faster than the world's oceans. This will also stimulate blooms of harmful algae in the lakes, leading to toxic cyanobacteria. Other potential consequences include less habitat for coldwater fish, more suitable temperatures for aquatic invasive species and hazardous algal blooms, and more mobilization of contaminated sediments as well as nutrients and toxic chemicals from urban and agricultural runoff.

Scientists also know that freshwater temperatures are rising because warm-water species are moving into areas that were previously too cold, while cool and cold-water species are likewise on the move. Studies are currently conducted in an attempt to alter the rapid climate changes in the lakes around the world because of the global warming effects. These studies will take a long time to try to control all the factors going into this increasingly fast change.

The consequences of the ice melting are incredibly hazardous to the source of livelihood for people who live around those lakes, as well as animals, which would be forced to abandon their natural habitats.

References

itechpost.com
livescience.com
nwf.org

Sea Floor GEOLOGY

By: Mona Shehata

Geological oceanography is a field that studies the ocean floor's history and structure; that is, studying the solid rocks and basins where the oceans lie. It relies on other fields such as paleontology, sedimentology, geochemistry, geophysics, etc.

You would wonder why oceanographers study the ocean floor. They do so to comprehend and predict climate changes and their effect on the oceans and shores. Moreover, studying ocean floor helps preserve the planet and its equilibrium, and discover resources as petroleum and minerals, through conducting research expeditions using boats, scuba diving or using submersibles.

At the start of the 20th century, oceanographers faced problems with sea floor mapping as they used wired soundings(1), the results of which were marked on isobaths(2) and early bathymetric(3) charts of shelf topography that provided the earliest glimpse of sea floor morphology. However, inaccurate depth and horizontal positional accuracy resulted in mapping errors.

The use of sonar echo sounding in naval warfare in World War I and World War II aroused civilian scientists' curiosity; they started using this cheaper method to study the sea floor. Sonar echo sounding sends sound waves to the sea floor awaiting their echo sounding. Since sound travels at a fixed speed in water, the time it takes to travel through water and echo back to the ship provides the distance to the sea floor; therefore, the faster the sound echoes back, the shallower the water is.

Columbia University geological oceanographers Bruce Heezen and Marie Tharp were the first to create a three-dimensional physiographic map of the world's ocean basins, printed by the National Geographic Society in 1956. This bathymetric map led to the discovery of chains of underwater volcanoes and deep ocean trenches surrounding Earth, resulting in a revolution in geological oceanography and plate tectonics theory in the following two decades.

Oceanographers create a bathymetric profile of an ocean basin; for example, one of the Pacific Ocean, which highlights the sea floor features:

- Continental Shelf: It is the continents' shoal submerged margins. Some are extremely wide like North America and South America East Coasts, while others are extremely narrow as their West Coasts. Across geological time, the shorelines retreat or advance according to the growth or shrinkage of the ice of the two Poles and the global rise and fall of sea levels.
- Continental Slope and Rise: The Slope is the sudden transition from the continental shelf to the ocean depths. It is interrupted by large canyons, which move turbidity currents; the rise is the accumulation of sediments at the slope's bottom.
- Mid-Ocean Ridge: The most important aspect of Heezen and Tharp's bathymetric map was the mid-ocean ridge system, an uninterrupted chain of low, uniform volcanoes, which stretches along the ocean basins. It is a vast elevation with a tiny valley at its center, such as the Mid-Atlantic Ridge between Africa and South America. Gentle volcanic eruptions pour molten lava into the ridge axis valley which when it cools down, becomes the new sea floor.
- Ocean Trenches: Trenches are bottomless, curved underwater valleys present on the edges of the ocean basins; they are the oceans' deepest locations. At this point, a process known as subduction occurs, where the travelling sea floor is recycled inside the Earth's interior at these trenches.
- Abyssal Plains: They are enormous, flat terrains of deep ocean floor. Sometimes small groups of sharp-topped ridges, known as abyssal hills, cut this almost smooth sea floor. On inspecting the abyssal hills, scientists found out that they are the tops of slant rock blocks under a layer of deep ocean sediment.

The solid rock on the sea floor is unlike that present on the continental rock. The former is thinner, deeper, and dark-colored, and contains more magnesium and iron than that of the Earth's surface. Mid-ocean ridge volcanoes deposit basalt, which is an integral part of the ocean floor. The sediment that covers the abyssal plains on the ocean floor, known as pelagic ooze, formed by the constant slow amassment of silica-and-calcium that are abundant in microscopic animals and plant remnants, which fall until they reach the ocean floor. The latter contains unpolished, light-colored rocks such as granite.

The borders separating ocean rocks from continental ones are under large sediment fans, which create continental margins. Continental margins, like continental slopes and shelves are thick sediment layers, which glaciers and rivers move from the continental interior.

This highly interesting field of study keeps progressing mainly due to increased interest in the effect of sea floor geology on the environment and the discovery of new resources. This inspires many people to pursue a career in this field due to its importance in today's world.

Glossary

(1) **Wired soundings** are short ropes and chains used by navigators to measure water depth.

(2) **Isobaths** are imaginary lines or lines on a map or chart which connect all locations having the same depth below a water surface (as those of an ocean, a sea, or a lake).

(3) **Bathymetry** is the ocean depth in relation to sea level.

References

biography.yourdictionary.com
merriam-webster.com
ngdc.noaa.gov
oceanservice.noaa.gov
watersome.blogspot.com

By: Jailane Salem

PROTECTING OUR SEAS

Biodiversity is what we use to describe the large variety of life on Earth, including the variety within, as well as between, species. All species live within ecosystems that are structured in such an intricate way that all those within it rely and depend for survival on each other. Ecosystems are, thus, sensitive to the slightest change, which can cause ripples that disturb the delicate balance in place.

Looking at marine ecosystems—oceans, estuaries, coral reefs, the sea floor, just to name a few—we can see how human intervention has caused great distress. As a result, conservation organizations try to restore marine ecosystems and prevent damage in the first place. Before looking at the steps being taken by marine conservationists, let us first have a look at the problems that our marine ecosystems face.

Fishing has been one of the ways humans have sustained themselves since the beginning of time; the boundless bounty of the seas was erroneously believed to be infinite. In modern time, with the advancement of fishing equipment and technologies, including the use of sonar and satellite equipment to locate catch, some areas have suffered from overfishing. Some have even become "dead zones", meaning life in those areas has been destroyed, and ecosystems have become terribly degraded.

The problem occurs when specific species of fish are targeted for fishing, and are overfished to the extent that their population cannot recover and bounce back. This disturbs the balance of the ecosystem, and in some instances, causes permanent changes and destruction to wildlife. When one species is overfished to that extent, people move on to another species, repeating the same vicious cycle, causing great harm with their short-sightedness. While this causes environmental problems, it also causes economic problems, because in some areas fishing becomes commercially non-viable, leading to loss of jobs and affecting coastal communities that rely on them for subsistence.

As fish populations decrease due to unsustainable practices, some have taken to aggressive fishing methods. One such method is trawling, which is pulling a large fishing net by one or several boats. Such methods can cause the bycatch of species that were not targeted, but end up dying when caught in the nets. Dolphins and porpoises are two of the species that commonly suffer from this fate, leading to a sharp decline in their numbers.

Another problem is when these fishing boats implement bottom trawling, which is when they drag the nets across the seabed floor. This causes great disturbances to the floor and creates large muddy waters in its trail that disturb debris and pollutants. It also can greatly damage sensitive coral reefs that take long to recover, if they ever do.

These are but a small number of destructive methods of fishing that are causing depletion in marine biodiversity; they occur due to inadequate policies. There is also a lack of political will to take a stand and defend the waters from our predatory actions; however, there have been calls to change our ways. Usually, at the forefront of the battle to save our environment are Non-Governmental Organizations (NGOs) that work in conservation and urge policy makers to take action and promote a more holistic approach to our environment.

Some of the ways being implemented to protect marine life is the creation of protected zones where fishing and human intervention is prohibited. This allows marine ecosystems and biodiversity to regroup and heal from previous mismanagement. Another tactic is the creation of a certification system that acts as an incentive for the fishing industry to clean up its act and harvest food in a more sustainable and environmentally conscientious way, and to also improve its fishing techniques to limit the bycatch of unwanted species.

One of the most well-known conservation organizations is the World Wide Fund for Nature (WWF), which was founded in Switzerland in 1961. Its mission is to reduce the impact of humanity's footprint on the environment and stop the degradation of the Earth's environment.

What we can do as individuals to help in this worldwide effort is to buy seafood from vendors who adhere to sustainable ways of fishing, whether in the sea or commercial fish farms. We should teach our children the importance of this issue in order to create a collective consciousness that views the environment as a precious gift to be respected, protected and loved, to ensure it continues to exist in a good state for future generations.

References

billionaire.com
blog.nature.org
issues.org
wwf.org.au

UNDERGROUND WATER

HELIUM LEVELS: WARNING

Japanese researchers at the University of Tokyo have conducted several studies, including some following the earthquake in Kobe in 1995. The studies indicated that the stress on the Earth's crust increases when the levels of underground helium increases.

Scientists have noticed a correlation between the rise in the levels of helium in groundwater and the stress on the inner rock found near the epicenter of the Kumamoto earthquake in 2016; a magnitude 7.3 quake in southwestern Japan, which resulted in 50 fatalities and serious damages. Groundwater samples were obtained through submersible pumps in deep wells at depths 280–1,300 meters from seven locations in the fault zones surrounding the epicenter eleven days following the earthquake in April 2016. They were compared to previous samples obtained in 2010 from identical analyses.

By: Soha Elborgy

Scientists not only revealed that the levels of helium-4 had risen in rock samples collected near the epicenter due to the gas released by rock fractures, but also estimated the amount of helium released through fracture experiments in the laboratory. Furthermore, they calculated the amount of strain exerted at the sites for groundwater sample collection using satellite data. The outcomes of these analyses have shown a relation between helium amounts in groundwater and the stress exertion, where the levels of helium have increased in the sites near the epicenter. The team found that helium concentrations were lower further away from the most intense seismic activity.

This means that there is a form of helium known as helium-4 that is trapped under the Earth's crust; when much stress is exerted on the crust, rock layers fracture, allowing helium gas to escape through the cracks, where some of it becomes trapped by the water in and on the ground. As such, by simply monitoring the levels of groundwater helium, the outbreak of earthquakes could be detected, giving the inhabitants enough time to evacuate and spare the lives of many.

Previous studies had found that changes to the chemical makeup of groundwater might occur before earthquakes, including some following the Great Hanshin quake in 1996. That quake's epicenter was about 20 kilometers from Kobe, Japan—a city of about 1.5 million people—causing 6,434 casualties and roughly USD 200 billion in damages. However, researchers still needed to collect evidence to link the occurrence of earthquakes to such chemical changes before establishing a strong correlation between the two. They need to have a base sample of the amount of helium present at a particular area; then, said area had to be hit by an earthquake, so that they can test helium levels afterwards.

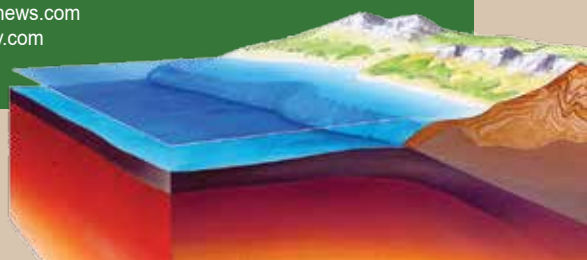
The question now is where to seek out places to establish baseline groundwater helium levels. It is possible that areas along a fault line are more likely to be hit by earthquakes and helium levels could be tested in the groundwater there, but it still seems a bit "hit or miss" as a means to establishing a true earthquake prediction solution.

"More studies should be conducted to verify our correlation in other earthquake areas", says Sano, the study's lead author. He continues, "It is important to make on-site observations in studying earthquakes and other natural phenomena, as this approach provided us with invaluable insight in investigating the Kumamoto earthquake".

This relation between groundwater helium levels and earthquakes, if proven, would help scientists develop a system that detects stress changes, which could foreshadow any upcoming earthquakes.

The field of scientific research is literally the gift that keeps on giving; there will always be a new theory to test, and a new discovery to be made. A key warning for earthquakes, one of nature's most potentially devastating disasters that could happen anywhere, anytime, could be a major lifesaving breakthrough and gift of Earth sciences.

References
askzephyr.com
courthousenews.com
sciencedaily.com



Rare Earth Elements

By: Sara Khattab

It is not widely known that most modern technologies that shape our daily lives nowadays depend on a group of seventeen rare earth elements, fifteen of which occur in the Lanthanide Series in the Periodic Table, in addition to scandium and yttrium. When they were first discovered in the 18th century, rare earth elements were found to be a component of complex oxides that occur together in geologic deposits. Some of the rare elements were named after the scientists who discovered them, while others are named after their geographical discovery.

Even though most of these elements are abundant in nature, they are very difficult to mine, because it is unusual to find them in concentrations high enough for economical extraction. Moreover, the process of purifying and separating these metals from their oxides was long, tedious, and costly. Nowadays, more advanced processes are used to produce highly pure and low cost elements; nevertheless, they are still called Rare Earth Elements.

Rare Earth Elements share common properties; for example, they are all silver, silvery-white, or gray metal. As metals, they have high electrical conductivity; their presence in alloys and oxide compounds can provide enhanced and unique strength, as well as magnetic, luminescent, and electrochemical properties. Industries took advantage of these unique properties, applying them in new technologies that have led to global economic growth and helped maintain high standards of living.

In metallurgy—a branch of science and technology concerned with the properties of metals and their production—when these elements are alloyed with steel, they increase the steel's strength and thermal stability; they are also used as catalysts in many chemicals and oils refining and manufacturing. Rare Earth Elements are used in cracking of petroleum, where they increase the amount of short hydrocarbon molecules in the product, making the refining of crude oil into gasoline more efficient.

Moreover, Rare Earth Elements contribute in the glass and ceramics industry; they are used as high temperature materials for coating, polishing, coloring, and discoloring. Praseodymium is also considered an important component of a special glass used to make strong masks to protect welders and glassmakers.

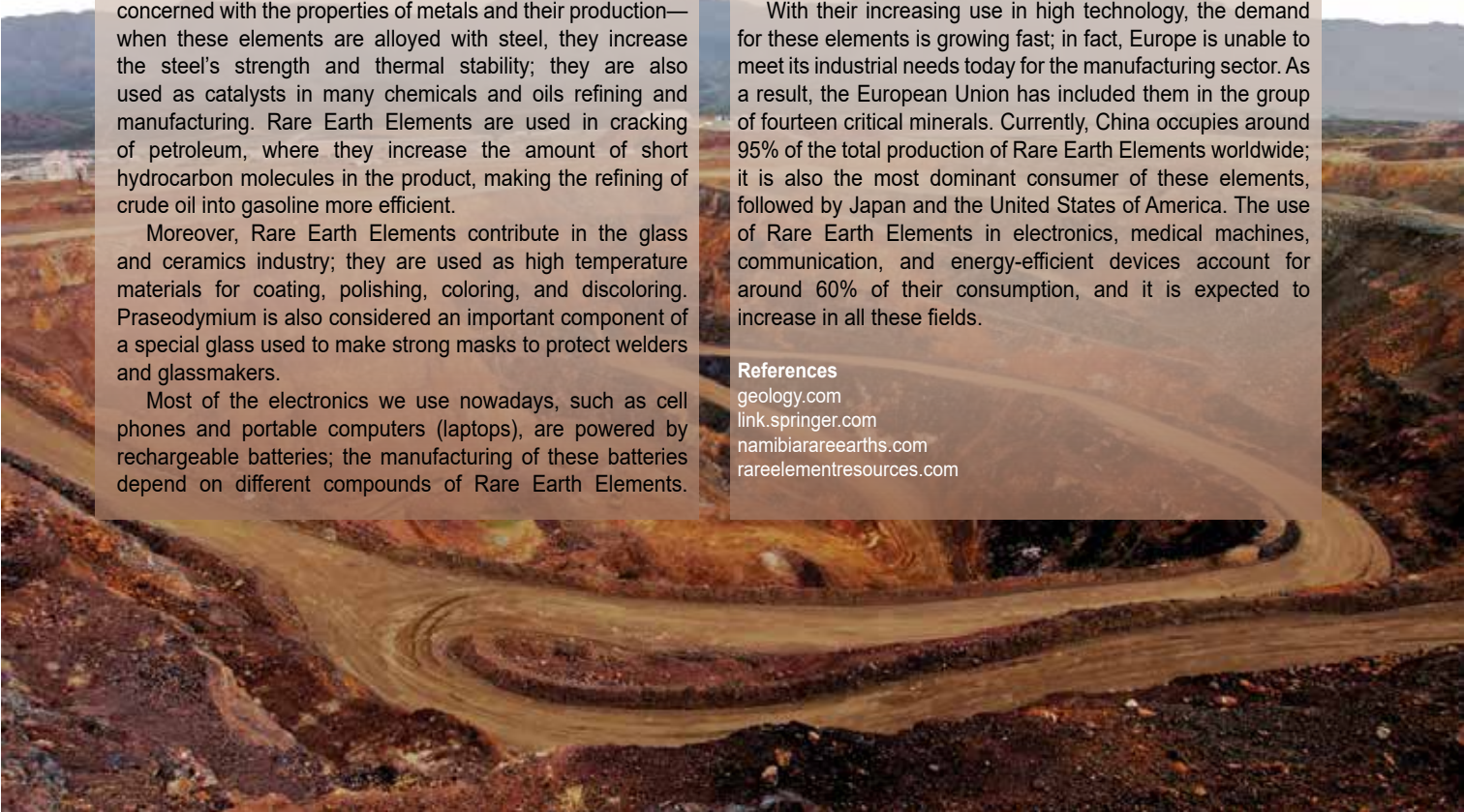
Most of the electronics we use nowadays, such as cell phones and portable computers (laptops), are powered by rechargeable batteries; the manufacturing of these batteries depend on different compounds of Rare Earth Elements. Yttrium, terbium, and europium are also important for the process of generating color displays on devices such as television screens.

Due to their powerful magnetic properties, Rare Earth Elements can retain their magnetic strength at high temperatures, making them ideal for commercial and aerospace applications. They are also essential to medicine, as they produce powerful magnetic fields used in medical imaging devices such as X-rays and MRIs.

Clean energy technologies depend on Rare Earth Elements as well. Most energy-efficient lighting—such as compact fluorescent lamps; and display panels—such as LEDs, plasma, and LCDs—require the use of Rare Earth Elements in the form of phosphors, which help reduce carbon dioxide emissions, consume less energy, and last longer. Furthermore, using earth magnets and magnetic refrigeration could potentially improve the energy efficiency of refrigerators for home and commercial use.

Another application of Rare Earth Elements in clean energy production is transportation and the new generation of vehicles designed to reduce energy consumption. Elements, such as Lanthanum and Cerium, are found in catalytic convertors in cars; these convertors are attached to exhaust systems of combustion engines, to reduce harmful air pollutants. Today, hybrid cars and electric vehicles carry around 4–5 kg of Lanthanum; compounds containing Lanthanum are also used in carbon lighting applications, such as camera and telescopes lenses and cinema projection.

With their increasing use in high technology, the demand for these elements is growing fast; in fact, Europe is unable to meet its industrial needs today for the manufacturing sector. As a result, the European Union has included them in the group of fourteen critical minerals. Currently, China occupies around 95% of the total production of Rare Earth Elements worldwide; it is also the most dominant consumer of these elements, followed by Japan and the United States of America. The use of Rare Earth Elements in electronics, medical machines, communication, and energy-efficient devices account for around 60% of their consumption, and it is expected to increase in all these fields.



References

geology.com
link.springer.com
namibiarareearths.com
rareelementresources.com

By: Hend Fathy

The Mysterious Case of the BERMUDA TRIANGLE

The Bermuda Triangle is an area in the Atlantic Ocean notorious for being the location of dozens of mysterious accidents and disappearances that many refused to dismiss as coincidental. In most cases, no wreckage was found, though some ships were discovered completely abandoned for no apparent reason. As mysterious as it would read, when you dig deeper, the case becomes less puzzling. You will find that some of the disappearances were never in the area to begin with, and many others have been rationally explained and ascribed to human errors or environmental effects.

The boundaries of the Bermuda Triangle are not universally agreed upon; it is roughly situated between the Southeastern Coast of the United States of America, Bermuda, and Puerto Rico. Many official institutions consider it an imaginary area; for instance, the United States Board on Geographic Names neither recognizes the Bermuda Triangle, nor maintains an official file on it. So, what fueled the Bermuda Triangle fever?

The name "Bermuda Triangle" was coined in 1963 by American author Vincent Gaddis in an article for Argosy Magazine; he claimed that supernatural dark forces are at work in the area. Gaddis's article lacked scientific evidence and raised much speculation; however, it came out at a perfect timing, shortly after the loss of two US Air Force aircrafts. Later, Charles Berlitz's The Bermuda Triangle (1974), which blamed the losses on aliens and survivors from the fictional lost civilization, Atlantis, became an international bestseller.

This does not necessarily deny the claims of odd experiences in the Bermuda Triangle; science has actually proved deviations from the norm in the area. The most recent was in October 2016, when a group of satellite meteorologists announced that an unusual type of clouds in the area stands behind the mysterious incidents. Dr. Randy Cerveny of Arizona State University said there are huge hexagonal-shaped clouds causing "air bombs" that hit the ocean and create massive waves. The resulting violent unexpected storms are so powerful that ships and airplanes can be plunged into the ocean instantly.

Other environmental causes include underwater earthquakes, as scientists found a great deal of seismic activity in the area. Moreover, the Triangle is located in the Gulf Stream Current, which is so powerful and swift that it can pose serious navigational challenges for inexperienced sailors. The Gulf Stream is fast enough to erase any evidence of disaster. Underwater topography may also be a factor; the Bermuda Triangle is home to some of the deepest trenches on Earth, making it almost impossible to find sinking ships or airplanes.

Another argument is that of methane gas hydrates. Scientists at Cardiff University discovered large concentrations of methane gas trapped in the ocean floor due to decomposing sea organisms. Ocean floor sediments contain a methane-producing bacteria; the methane accumulates and concentrates forming gas hydrates. If a methane pocket ruptures, the gas suddenly erupts, causing the water to be less dense; this would sink any ship in the area and sediments could quickly cover it as it settles onto the sea-floor.

Moreover, many pilots reported magnetic abnormalities in the area; in 1970, Bruce Gernon reported a strange cloud that spread out and formed a tunnel as he passed through it. His navigational instruments went haywire and the compass needle went counterclockwise; his airplane disappeared from the Miami Air Traffic Control radar, then was suddenly spotted as he passed the cloud. Surprisingly, there was a time gap of around 30 minutes of his flight confirmed by his watch and the airplane's clock, which led him to believe the fog had time travel qualities. No clear cut scientific explanation has deciphered this phenomenon.

Another very popular explanation that entailed human error was that pilots and sailors fail to account for the agonic line passing through the area, which causes significant navigational errors and catastrophes. The agonic line is where true north and magnetic north are in perfect alignment; hence, there is no magnetic declination and no need to compensate for magnetic compass variation. However, this theory is no more valid since scientists proved the agonic line is drifting westwards with an average velocity of about 0.2 degrees yearly. It once passed through the Bermuda Triangle; yet, it now falls within the Gulf of Mexico.

Time after time, science would prove it has the final say in every fact-versus-myth battle. Breathtaking tales and headlines can be tempting or even appealing; legends will keep finding their way into human minds, but science will remain our defense mechanism against them.

References

adventure.howstuffworks.com
britannica.com
independent.co.uk
telegraph.co.uk

By: Esraa Ali

The Rite of Spring

I am a big fan of Disney animation; in that way, Disney's 1940 animated feature film Fantasia has held a special place in my heart. I remember watching it as a little kid, and still vividly recall its segments. They were delightful when Mickey Mouse became a magician, humorous when a hippopotamus did ballet, and scary when demons and witches made an appearance. Yet, one unique segment attracted everyone's attention, embedding itself in the minds of many for a lifetime; a segment about the history of Earth featuring the rise and fall of the dinosaurs, and known as *The Rite of Spring*.

The idea of Fantasia initiated in 1937, when Walt Disney discussed with one of the leading conductors of the early 20th century, Leopold Stokowski, a musical short he was working on. The idea developed into a feature animation set to classical music. The two spent months selecting classical pieces, which Stokowski arranged and recorded with his orchestra, and Disney and his fellow artists expressed through their drawings.

In his film, Disney chose to put the then-emerging scientific version of the Earth's creation on the screen, set to Igor Stravinsky's brilliant and revolutionary work, *the Rite of Spring* ballet. Rather than presenting Stravinsky's music in the form of a simple series of dances, Disney visualized it as a parade depicting the prehistoric world. It fused science and art, as described by many "imagination based on facts", where research and accuracy were the segment's integral components.

Deems Taylor, an American composer and promoter of classical music, acts as the film's master of ceremonies, presented the segment, saying: "Science, not art, wrote the scenario of this picture". The story presented in this segment, as described by Taylor "is not the product of anybody's imagination. It is a coldly accurate reproduction of what science thinks went on during the first few billion years of this planet's existence".

The Rite of Spring, the longest segment in Fantasia, starts with the early formation of Earth, before there was any life. "So now, imagine yourselves out in space, billions and billions of years ago, looking down on this lonely, tormented, little planet, spinning through an empty sea of nothingness," said Taylor introducing the segment.

After presenting a view of the Milky Way in the distance, Disney artists successfully painted a frame no photograph had yet captured, which is the view of our Earth as seen from outer space. The scene is followed by a closer frame of Earth, which is hot and volcanic. Some of the most incredible animation lies in the scenes of erupting volcanoes, boiling lava and its flow over the Earth's surface, the gradual formation of seas, and the single-celled life inside them.

According to science, the first life forms were single-celled organisms, which developed under the sea; and then, all kinds of marine creatures were there. After one billion years, an ambitious fish crawled up on land, resulting in the emergence of animal life and the rise of dinosaurs.

To portray the planet's early inhabitants, Disney consulted specialists and advised the artists not to make them cute animal personalities, but to make them real.

Accordingly, pet iguanas and a baby alligator were brought to the Studio to inspire the animators. The fight for life supplied the organizing idea of the segment, where the artists animated the ferocious battle between the Tyrannosaurus rex and the Stegosaurus.

The segment ends with great droughts, massive earthquakes, and floods that wiped everything clean. These groundbreaking scientific discoveries displayed on screen have helped turn millions of children into dinosaur enthusiasts and great evolutionary biologists.

Personally, I adore Fantasia as a whole and I would recommend it to everyone, especially animation and music fans. I would like to remind you that none of the film graphics were generated by computer; they were all made by hand before any computer animation techniques were applied, and the music was performed live by a real orchestra. The film is considered a truly avant-garde work at the time of production, and if you are going to judge the film, please try to think using the standards of the 1940s not ours.

References

Thomas F. Kelly, *First Nights: Five Musical Premieres*
Terry Teachout, *Why Fantasia Mattered?*
Alex Ross. *The Rest is Noise*
Douglas Brode, *From Walt to Woodstock: How Disney Created the Counterculture*
new-savanna.blogspot.com
teepee12.com
whendinosaursruledthemind.wordpress.com
evolutionnews.org

By: Basma Fawzy

James Hutton:
The Father of Geology

Up until the 18th century, it was generally believed that Earth was only 6000 years old; it was only when James Hutton introduced his ideas that this belief was completely shattered. Hutton was a Scottish scientist born in 1726; he was educated in the local grammar school and then joined the University of Edinburgh. His interests were diverse; he enjoyed chemistry, entered a legal profession, and earned a degree in medicine.

He also examined the manufacture of sal ammoniac, and later became interested in farming; eventually, he was making a lot of money from his farm and from the manufacture of sal ammoniac. His business provided him enough money to pursue his interest, which he is most known for today: Geology.

At that time, Neptunists—a group of scientists named after Neptune, the Roman god of the sea—believed that in the past Earth was covered by an Ocean. They, also, believed that sediments formed the granite and crystalline rocks, and when seawater receded, "stratified" rocks appeared. Hutton, a leader of Plutonists—a group of scientists named after Pluto, the Roman god of the underworld—held totally different beliefs. According to Plutonists, the Earth is a dynamic body; it did not just come into being and then retained the same shape, but rather functions as a heat machine.

Hutton noted that subterranean heat, coming from under the surface of the Earth, led to the expansion of its outer parts; this eventually uplifted marine sediments and formed new continents. He noticed that granite is an intrusive igneous rock; he also noticed some unconformities in the rocks, which led him to believe that most rocks are not merely a product of sedimentation, but rather a product of sedimentation, uplift, and erosion.

This means that Earth undergoes a dynamic process and that it continually changes. In simpler words, rocks are eroded, the particles are buried deep in the sea, and the heat binds those particles together. Eventually, the heat uplifts the fused rocks up to form new continents; the process is always repeated. This means that Earth is definitely older than 6000 years. Hutton's theory of Earth, which was announced in 1785, is his most important contribution to geology, and because of this theory, he is named the "Father of Geology".

His theory also paved the way for one of the major concepts of geology: uniformitarianism or gradualism. According to uniformitarianism, the Earth's shape is the product of a gradual process that has been occurring for thousands of years. Hutton believed that the same processes, which take place in the present, have also taken place in the past; that is, Earth is always being reshaped. Unlike gradualism, catastrophism states that Earth was affected by violent events, or catastrophes, which played an important role in shaping Earth. Hutton's significance lies in his introduction to a concept that plays a great role in understanding Earth's history.

Hutton is an important figure, because up until he came up with his theory about Earth, the world had not benefited from the wealth of knowledge present at the time. There was already a lot of information about rocks and fossils; yet, the belief that Earth was only 6000 years old was a stumbling block, because it left many questions unanswered. In a sense, Hutton's theory collected the pieces of the puzzle and made sense of all the information available about Earth at that time. Hutton's work more or less rocked the Earth; he questioned many of the prevailing ideas about Earth and its history.

For the first time, people realized that Earth was older than previously imagined; Hutton's ideas helped put previous information into perspective. It is important to mention that Hutton's work and ideas would not have had enough popularity without the effort of his close friend, John Playfair. Hutton's style was difficult to understand, but Playfair rewrote his theories and ideas in an easy to understand way, while adding his own notes and observations in his publication entitled *Illustrations of the Huttonian Theory of the Earth*. Geology owes a lot to Hutton's theories and also to Playfair's help in making the work of this great scientist approachable.

References

britannica.com
encyclopedia.com
famousscientists.org
publish.illinois.edu

By: Dr. Omar Fikry
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Peace Be Upon You, O Abu Abdullah

Every day, on my way to my office, which is located beneath the Bibliotheca Alexandrina (BA) Planetarium, I pass by the History of Science Museum Hall, which contains panels that resemble the pages of an enormous book. Each panel covers a certain scientific topic within Ancient Civilizations; every now and then, I pass by the Hall to have a glimpse on one of these topics. Sometimes though, I go there specifically to admire one of the Arab or non-Arab scientists. I stand there thinking of how they contributed to the development and accumulation of our scientific and historical knowledge.

Today, I stood in front of Al-Idrisi's panel, known as Abu Abdullah, but his full name is Abu Abdullah Muhammad bin Muhammad Al-Idrisi. The caption on this eminent scientist's panel states the following:

"Asharif Al-Idrisi; as the title indicates, is a descendant of Prophet Muhammad (peace be upon him). His family ruled Malaga in Andalusia in the 11th century; he was born in Sabtah in Morocco in the 5th Hijri century (end–11th century or early 12th century). After receiving his education, Al-Idrisi travelled to Andalusia, Minor Asia, and North Africa. Upon receiving an invitation from the Norman King Roger II of Sicily (1130–1154 CE), Al-Idrisi travelled to Sicily, where he created a silver world map and planisphere, which he gifted to the King.

Al-Idrisi began writing his famous book of geography *Nuzhat Al-mushtāq fī Ikhtirāq Al-āfāq (The Pleasure Excursion of One Who Is Eager to Traverse the Regions of the World)*, the contents of which took him 15 years to compile and edit. The Book is commonly known as *The Book of Roger*, as King Roger II had protected and supported Al-Idrisi to complete his work, which he gifted to the King. After King Roger II passed away, Al-Idrisi resumed his work at the court of William I (1154–1166 CE) until he gifted the King another book of geography, the size of which is larger than the first one. An abridged version of *The Book of Roger* was printed in Rome, in 1952, by the Medici Press. A Latin translation was also printed in Paris, in 1619; although the whole book was not fully translated into French until two centuries later.

This abstract did not quench my thirst for knowledge; indeed, it intrigued my curiosity and desire to learn more about Al-Idrisi. How, for example, a scientist spends fifteen years of his life gathering and writing a book? What is the relationship between Al-Idrisi and his supporters who helped him carry on his research and writings? To my good opportunity, I work at the BA, so I did not find any difficulty in moving from my office and heading to the BA Reading Area. With research, I found plenty of books and references about this scientist of such great stature. I would recommend some of these books to the reader to quench:

- Mohamed Siddiq El-Minshawi, *Asharif Al-Idrisi: The World's Greatest Geographer*
- Soliman Fayad, *Al-Idrisi: The Father of Geography*
- Ibrahim Khouri, *Asharif Al-Idrisi: Nuzhat Al-mushtāq fī Ikhtirāq Al-āfāq*
- Sami Albagirmi, *Al-Idrisi and The Spherical Model*
- Mohamed Kamal, *Asharif Al-Idrisi.*

I found many more works, and I could conclude from all what I read that Al-Idrisi was a pioneer geographer, who had thorough observation and wealth of knowledge. His approach was characterized by a serious attempt to combine descriptive and astronomical geography. Description prevailed in his works, which was apparent in his description of Earth as stable in space like "the yolk in an egg". Al-Idrisi followed Ptolemy's footsteps by slicing Earth into seven regions, which are latitudes above the Equator. Adding to his predecessors' works, Al-Idrisi divided the seven regions into seventy longitudinal sections; each section was illustrated in a separate flat map, which when put together, from west to east, constituted a general complete world map.

Al-Idrisi's interests were not limited to astronomy and geography; he also tackled other areas, such as medicine, pharmacology, and botany. In the second half of the 20th century, in one of Istanbul's libraries, a manuscript was found, where the first half included a thesis in medicine preparation by Al-Idrisi. He authored this book in the form of a dictionary, which includes most of the pharmaceutical names listed alphabetically and interpreted into Berber, Coptic, Greek, Latin, Persian, and Syriac languages. Al-Idrisi mentioned the benefits of each and the useful materials extracted from them.

After all what I have read about Al-Idrisi, I returned back to his panel and said with all the respect and admiration "peace be upon you, O Abu Abdullah".

EGYPT: THE BEGINNING

By: Dr. Tarek El Awady
Former Director,
BA Antiquities Museum

This fertile land, Egypt, daughter of the Nile, irrigated by its waters for thousands of years, was not in that remote past the land we know now. Egypt was once part of a huge ocean floor; however, the ocean abandoned it, allowing a new form of life to thrive on its surface in a world mastered by a creature endowed by our Creator with a mind that understands, thinks, and stores knowledge.

Despite abandoning the land, the ancient ocean left its significant mark in the depth of the deserts in the form of fossilized marine creatures, tiny, small, or huge, reaching the size of enormous whales of different types and species. Fossils include whales that sauntered on legs before turning into fins, when the whales refused to stay on land, leaving it with the receding water, or preferring to die in its place rather than experiencing the unknown.

The land turned into a forest and pasturage for different wild animals, including gigantic dinosaurs that shook the land during their quest to eat and drink; there were also small dinosaurs the size of a goat. The wild life continued for thousands of years; it witnessed rainy ages and others icy; the Earth's crust was still forming, with enormous volcanoes releasing mountains, and grooves cleaved by earthquakes and filled with flood water. Generation after generation, living creatures continued to mutate to adapt with the weather; some survived, while others vanished.

Drought eras hit the land, starting with North Africa; as a result, some animals that were adapted to grass and water migrated South, while others stayed in their habitats, surviving with small amounts of water and grass, living around fresh water lakes that were formed during the rainy eras. At that time, there was a small freshwater stream that fed some tributaries coming from Red Sea mountains. The stream joined another larger stream coming from the depths of Africa and fed by many tributaries. Once threatened with extinction due to rain shortage in its eastern tributaries, the stream was resurrected to life with water from the South, later becoming its only source of water, along with some residue deposited by the river at the end of each journey, forming the greatest river delta on Earth.

Year after year, the River flooded, creating fertile land on its banks as black as Africa, which was and still is the epitome of Egypt's life. When did Egyptians emerge? When did this civilization start? The answer is in the Western Desert, where many places inhabited by cave-dwellers were revealed. Thousands of years ago, before cave-dwellers migrated to the River banks, he was living among wild creatures, digging caves and inhabiting them. He built snares to hunt big animals, managed his family demands from the available water, game and animal meat, and the delicious fruits and plants he found on trees.

This primitive man developed his life, starting with his tools, which he kept developing until they reached perfection; some even were considered pieces of art. He observed the Universe and learnt about his abilities and uniqueness, which led him to great inventions, such as, the stone weapon that could be attached to a wooden stick to form a hammer, an arrow, or a spear; the dry twigs that could be used to ignite a fire for cooking or heating.

The very first advantages of fire was its influence on the shape of Man himself; his sharp teeth and fangs in his big jaw began to be reformed bit by bit. His jaw became smaller than before, and his teeth became small and well-formed. Man liked his looks, and women started to wear jewelry made from shells and colored stones, even hair had ivory combs.

There has always been a strong motive for Man to develop whenever he can. The Western Desert discoveries prove the existence of Egyptians 35,000 years ago, in addition to the burial grounds that included creatures other than Man, which reflects the existence of religious and ideological thought back then. Fossils proved that Man existed during the Pastoral Period, when he domesticated animals.

When the rain receded, Man started to live next to the River. From the very beginning, the eternal bond between the Egyptian citizen and the Nile River started; a relationship that was never disrupted by either a riptide or years of strife and staleness from the immortal River, which has inspired Egyptian artists then and now. As a result, it became the common gene among all Egyptians; Pharaohs kings, nobles, the rich and the poor, they all drank from its water.

Year after year, the river flooded, creating fertile land on its banks as black as Africa, which was and still is the epitome of Egypt's life. When did Egyptians emerge? When did this civilization start?

EGYPTOLOGY:

CHAMPOLLION'S GIFT TO HUMANITY!

By: Dr. Shaymaa Elsherif
In Charge of Cultural Programs and Activities,
BA Center for Francophone Activities

"I am entirely dedicated to Egypt; she is everything to me." This was the immortal quote of Egypt's great admirer, the eminent French scientist, Professor Jean Francois Champollion (1832–1790), who passed away 185 years ago. Champollion is known for deciphering Egyptian hieroglyphs using the Rosetta Stone; thus, endowing humanity with the most valuable gift that is the Ancient Egyptian civilization.

At the age of seventeen, his ingenuity had already started showing, as he demonstrated great dexterity in learning ancient languages and comparing them. After completing his education at a young age, he was appointed Chair Professor of Egyptian Antiquities at Collège de France; he also published the first Coptic language dictionary in the world. Despite chronically suffering from gout and tuberculosis, Champollion never ceased to search, explore, and study. He was the first to raise a formal note to the Governor of Egypt, Muhammad Ali Pasha at that time, pleading him to issue a legislation to protect Egyptian antiquities from theft and prevent them from being traded.

Sickness and the hassle of travelling and searching extensively exhausted Champollion, bringing his life to an end on 4 March 1832, at the young age of forty-one. He lived a short, yet full life of great achievement. He was buried in the tombs of Père Lachaise in Paris; his tomb distinguished by a model of an Egyptian obelisk.

Champollion might have left our mortal world, but the Rosetta Stone, currently displayed at the British Museum in London, remains as witness on his immortality. The Rosetta Stone was accidentally discovered in 1799 by one of the soldiers of the French Expedition in Egypt. It is a stone made of diorite, with engraved text in two languages and three writings: Ancient Egyptian, first written in hieroglyphs, which is the sacred writing, because it was used inside temples; then in Demotic, meaning popular writing; and finally, the same text is written in Ancient Greek. Champollion succeeded in deciphering the Rosetta Stone by comparing between the three writings, as he had prior knowledge of the Coptic language from which Demotic language descended, in addition to his knowledge of the Ancient Greek language.

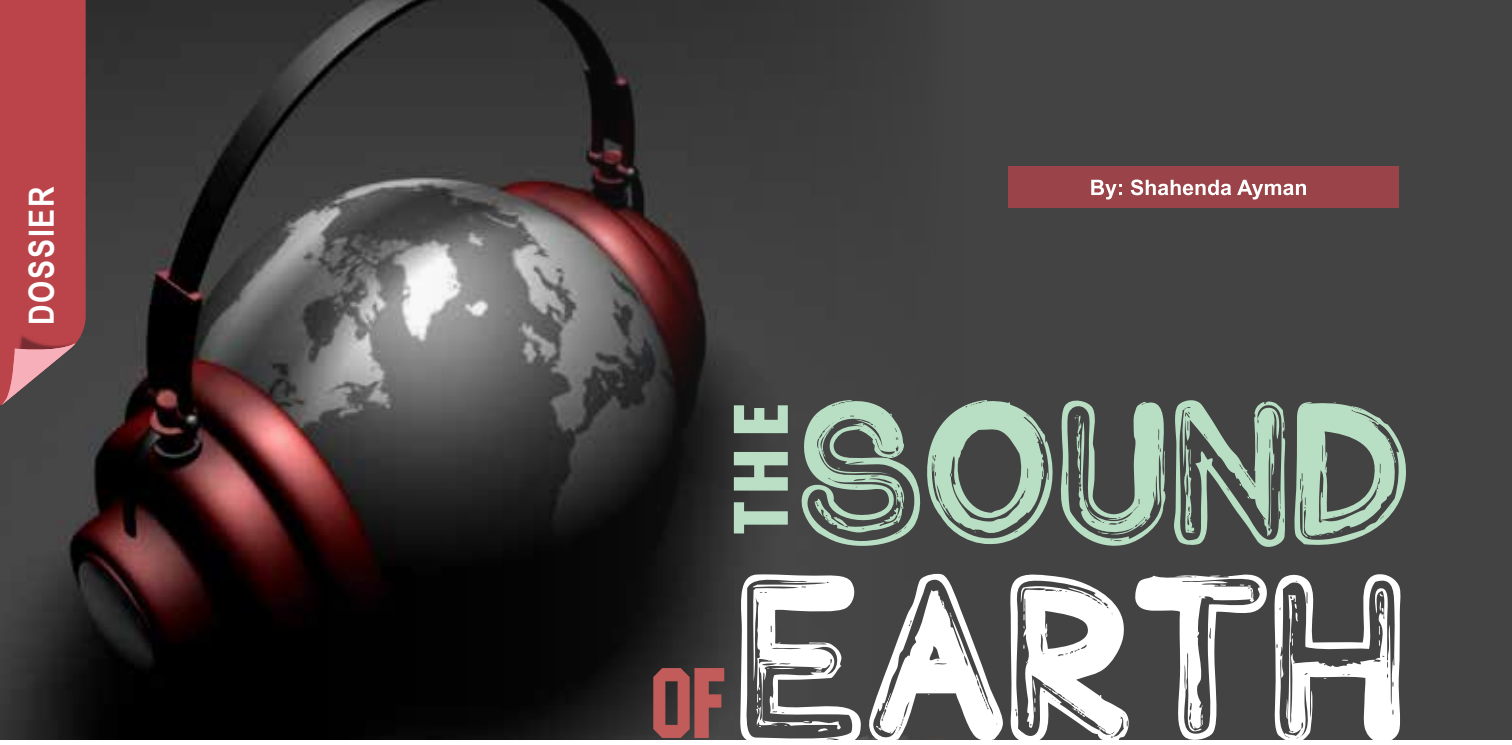
For this historic feat, Champollion is celebrated as the "Father of Egyptology" thanks to his contribution towards uncovering the secrets of the Ancient Egyptian civilization, enabling scientists to discover the details of the lives of Ancient Egyptians; in addition to their sciences, arts, as well as their social, economic, and political systems. After deciphering the symbols of the Rosetta Stone in 1822, Ancient Egyptian history was written based on fossil discoveries, papyri readings, paintings, and engravings on the walls of the temples and tombs.

In 1858, the researches of the great French scientist Auguste Mariette Pasha, along with the French expedition assisting him, reorganized, classified, and dated Egyptian antiquities; Mariette Pasha being the founder of the Egyptian Museum in Cairo. In 1922, the British traveler Howard Carter discovered the tomb of the young pharaoh Tutankhamun, thanks to the funding of Lord Carnarvon. The discovery attracted more attention to Egyptology, supporting it with many details and information.

It is thanks to Champollion's discovery that scientists are able to read many papyri; such as medical papyri, the most known of which the Edwin Smith Papyrus, the Brooklyn Papyrus, the Carlsberg Papyrus, and the Brugsch Papyrus. Moreover, the administrative regulations of the Ancient Egyptians were clearly evident in the Abusir Papyri, which are considered among the most important discoveries related to the administrative documents of the Old State. These papyri provided detailed information about operating the royal cadavers temple, including priests' work shifts, instruments' inventory, and lists of daily presentations of the two solar temples in Abu Ghorab, north of Abusir, as well as the related speeches and permits.

The Kahun Papyri offers a group of different topics and data in many fields, including worksheets of the sanctification of Senusret II, hymns to King Senusret III; in addition to medical information related to gynecology, a set of mathematical texts, and a papyrus about veterinary medicine. They also show details of the festivals celebrated at that time.

The oldest civilization in history was disclosed to humanity thanks to Champollion, who unlocked that chest of secrets, to dazzle the world then, now, and forever.



THE SOUND OF EARTH

By: Shahenda Ayman

Mother Nature is always speaking; she speaks in a language only the sincere listener can understand. In some places on Earth, the sand "sings" as it falls down dunes, making a low sound that lies within the bottom half of a cello's musical range. Those eerie sounds have frightened travelers for millennia.

Do not panic, it is the Earth amusing its inhabitants by its natural orchestra.

Sand dunes sing when the sand slides down their sides; people can set the sand in motion themselves. Sometimes the wind can create sand avalanches, creating a sudden, booming chorus. Scientists previously thought the sound happened because avalanching sand created vibrations in the more stable under-layers of the dunes. However, in 2009, University of France researchers found that the avalanche of sand itself sings, not the dunes.

To study this phenomenon, physicist Simon Dagois–Bohy and his fellow researchers at Paris Diderot University in France, recorded two different dunes: one near Tarfaya, a port town in southwestern Morocco; and one near Al-Askharah, a coastal town in southeastern Oman. In Morocco, the sands consistently produced a note at 105 hertz. The Omani sands also sang, but sometimes belted out a cacophony of almost every possible frequency 90–150 hertz.

Although the Omani dunes are somewhat sloppy singers, the researchers identified some tones that were slightly stronger than others. The scientists also observed that sand grains from the Omani dune came in a much wider range of sizes than their Moroccan counterparts. As a result, Dagois-Bohy and his colleagues brought grains from the Omani dune back to the lab.

They first ran the mix of Omani sands down a constructed incline, recording its sound and measuring the sand vibrations. They then used a sieve to isolate the sand grains between 200–250 microns, and ran that sand down the same slope. They compared the sound of the isolated sands with the sound of the mixed-size control and found that, while the grains of a broad size range sang noisily, the sands of a narrow size range sang a clear note at about 90 hertz, much like the Moroccan sands do naturally. This suggested that grain size is an important factor in what tone the dunes produce.

The research team suggests that the grain size affects the purity of tones generated by the dunes; when grain size varies, the streams of sand flow at varied speeds, producing a wider range of notes. When the grains of sand are all of the same size, the streams of sand within the avalanche move at more consistent speeds, causing the sound to narrow in on specific tones. However, scientists still do not know how the erratic motion of flowing grains translates into sounds coherent enough to resemble musical notes.

"The study attempts, and I think succeeds in many ways, to solve the problem of what the mechanism is" that translates tumbling sand into a song, said Tom Patitsas, a theoretical physicist at Laurentian University in Sudbury, Ontario, who did not participate in the study. Patitsas said the theory behind the sound still requires more elaboration to explain why, for example, the flowing sand still needs a thin layer of stationary sand underneath it to make a sound. He suggests the sliding sand resonates with similar-sized grains beneath the avalanche. Those buried grains may lie in chain-like patterns that intensify the resonance. "Once you have this resonance, the amplitude of the vibration will be large" Patitsas said.

In addition to the eerie sound of sand, the sky sometimes emits strange sounds too! Since 2008, or maybe earlier, people all

around the world have heard an extremely loud sound coming from the sky; the spooky sound is like someone blowing a trumpet. Dozens of people from across the globe have posted videos of these bizarre sounds, the origin of which is not yet fully understood.

As it is the nature of ordinary people, many chose to assume fantastic reasons, ranging from alien lifeforms to end of the world. However, scientists have analyzed records of these sounds and found that most of their spectrum lies within the infrasound range; what people hear is only a small fraction of the actual power of these sounds. In geophysics, they are called acoustic-gravity waves; they are formed in the upper atmosphere, at the atmosphere-ionosphere boundary in particular.

According to scientists, the source of such powerful and immense acoustic-gravity waves must be very large-scale energy processes. Such processes include powerful solar flares and huge energy flows generated by them, rushing towards Earth's surface and destabilizing the magnetosphere, ionosphere, and upper atmosphere.

Given the surge in solar activity as manifested in the higher number and energy of solar flares since mid-2011, we can assume that there is a high probability of impact of the substantial increase in solar activity on the generation of the unusual humming coming from the sky. The observed increase in solar activity is fully consistent with the forecast of the *International Committee GEOCHANGE* published in the Committee's Report in June 2010.

Another possible cause of these sounds may lie at the Earth's core. The acceleration of the drift of the Earth's North Magnetic Pole, which increased more than fivefold between 1998 and 2003, and is at the same level today, points to intensification of energy processes in the Earth's core, since it is processed in the inner and outer core that form the Earth's geomagnetic field.

Intensification of the energy processes in the Earth's core can modulate the geomagnetic field, which, through a chain of physical processes at the ionosphere, generates acoustic-gravity waves the audible range of which has been heard by people in the form of a frightening low-frequency sound in different parts of our planet.

The more we observe nature, the more it interests us with its phenomena. The next time you hear those bizarre sounds, do not panic, it is the Earth amusing its inhabitants by its natural orchestra.

References

bookofresearch.com
dailymail.co.uk
livescience.com
sciencedaily.com
smithsonianmag.com

VISITORS INFO

Planetarium

Available Shows

Enlightened Mind
19 min.

The Mission
24 min.

Stars Show
45 min.

Oasis in Space
25 min.

Stars of the Pharaohs
35 min.

Seven Wonders
30 min.

The Life of Trees
33 min.

Kaluoka'hina:
The Enchanted Reef
35 min.

To Space and Back
25 min.

Alexandria, The Cradle of Astronomy
22 min.

- For the Planetarium daily schedule and fees, please consult the Center's official website: www.bibalex.org/psc
- Kindly note that, for technical reasons, the Planetarium maintains the right to cancel or change shows at any time without prior notification.

History of Science Museum

Opening Hours
Sunday–Thursday: 9:30-16:00
Saturday: 12:00-16:00

Guided Tours Schedule
Sunday–Thursday:
10:30, 11:30, 12:30, 13:30, 14:30, 15:30

- Museum entry fees are included in all Planetarium shows tickets.
- For non-audience of the Planetarium, Museum entry fees are EGP 2.-
- Museum Tours are free for ticket holders.

ALEXploratorium

Discovery Zone

Opening Hours
Sunday, Monday, Wednesday, Thursday: 9:30-16:00
Tuesday: 9:30- 12:30
Saturday: 12:00-16:00

Guided Tours Schedule
Sunday, Monday, Wednesday, Thursday:
10:00, 11:00, 12:00, 13:00,14:00, 15:00
Saturday: 12:00, 13:00, 14:00
Tuesday: 10:00, 11:00

Entry Fees
Students: EGP 5.-
Non-students: EGP 10.-

Listen and Discover

- For the list of shows available at the "Listen and Discover" and the schedule, please consult the Center's official website: www.bibalex.org/psc.
- For reservation, please contact the PSC Administrator, at least one week before the desired date.

Show fees
DVD shows:
Students: EGP 2.-
Non-students: EGP 4.-
3D shows:
Students: EGP 5.-
Non-students: EGP 10.-
12D shows:
EGP 20.-

Check out the "The Sound of Earth" article, page 22.
Illustrated by: Mohamed Khamis