

HIGHER EDUCATION CENTRE SEZANA
Laboratory for Geomagnetism and Aeronomy

International Conference on Magnetism, Geomagnetism and Biomagnetism

MGB - 2008

Abstracts booklet

7. - 8. november 2008
Sezana, Slovenia

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INTERCHANGING THE EARTH'S MAGNETIC POLES

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ABSTRACT

Some facts related to constant change of magnetic field of the Earth and magnetic poles position are presented. In the early 20th century geologists first noticed that some volcanic rocks were magnetized in a direction opposite to what was expected. Magnetic field has never been observed to reverse by humans with instrumentation, and the mechanism of field generation is not well understood. Because of that, it is difficult to say what the characteristics of the magnetic field might be leading up to such a reversal

Keywords: magnetic field, magnetic poles, reversal

CONSEQUENCES OF MAGNETIC PHASE TRANSITION IN THE EARTH'S CRUST

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ABSTRACT

Kiss et al. [1] suggested to consider the phenomenon of second-order magnetic phase transition in the Earth's crust, as a possible source of geomagnetic and magnetotelluric anomalies. In that paper two consequences were mentioned: (1) some geomagnetic anomalies of unknown origin could be perhaps explained by a significant enhancement of the magnetic susceptibility at the Curie (Néel) depth, (2) this phenomenon might be also responsible for some magnetotelluric crustal conductivity anomalies. Since that time new problems and challenges have emerged. In this paper we refresh the conclusions, and summarize the new results. In spite of some scepticism, there are more and more theoretical and experimental results (in solid state physics), which bring more and more probable that magnetic phase transition sometimes might be a potential source of various geophysical crustal anomalies.

Keywords: Magnetic phase transition, Curie temperature, Hopkinson peak, crustal anomaly

INFLUENCE OF MAGNETIC STORMS ON COMPASS

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ABSTRACT

This article presents the nature of the Sun's and Earth's magnetic fields, their mutual connection and anomalies. The number of magnetic storms increases and decreases in unequal cycles which correspond to the increases and decreases in sunspots cycles. The Sun's plasma streams that shoot out from the sunspots cause an increase in the solar winds and in doing so they affect the geomagnetic field and the Earth's atmosphere. One example of such occasional causal connections was the very extreme magnetic storm that occurred during the last two Sun Cycles, and lasted from October 28th to November 2nd 2003. In that time extensive changes in the geomagnetic field were recorded. This resulted in additional coincidental errors in navigation magnetic instruments (compass). The magnetic compass is today an instrument of secondary importance, but it is included as compulsory in navigation devices with enhanced accuracy, reliability and robustness: integral navigation systems, autopilots, ARPA radars and systems for drilling platform adjustment. Today it is possible to forecast the appearance of a geomagnetic storm. This means that errors at navigation devices caused by such storms may also be predicted and that they may be managed systematically.

Keywords: Sunspots, solar cycles, geomagnetic field, geomagnetic storms, compass

SEISMOMAGNETIC INVESTIGATIONS IN KOPAONIK AREA

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ABSTRACT

In the complex of geophysical and other methods for investigation various appearances connected with preparation and manifestation of earthquake, seismomagnetic investigations have very important role. Repeated geophysical surveys (for instance seismomagnetic survey) are required for revealing temporal variations of physical rock properties associated with the accumulation of stress. Changes in earth's magnetic field observed prior to earthquakes are to be expected. Seismomagnetic investigations in the wider area of Kopaonik were initiated immediately after the May 18, 1980 earthquake ($M=6,0$). Also, in the Rudnik area investigations were initiated since 1979 and with some pauses are still managed. At these regions total field intensity surveys have been carried out, using the network of the stations in the wider area affected by the earthquake. Obtained results enabled us to follow spatial and temporal variations of local field changes. The distribution of these changes exhibits characteristic pattern which can be related to the seismicity in certain time period. By the comparison of spatial form of successive measurements we can obtain different seismicity of that region.

Keywords: seismomagnetism, geomagnetic field, precursor, proton precession magnetometer

MODERN FLUX-GATE MAGNETOMETERS DESIGN

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ABSTRACT

The most important metrological parameters of the flux-gate magnetometers - noise level, thermal drift, long-term stability - are considered. The ways of their improvement are analysed and some results of experimental investigation of the upgraded magnetometers are presented.

Keywords: flux-gate, magnetometer, sensor, noise, excitation, temperature

THREE DIMENSIONAL FLUXGATE MAGNETOMETER FOR MEASURING EARTH MAGNETIC FIELD

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ABSTRACT

The article presents the results of a software temperature compensation of a three dimensional fluxgate magnetometer. The magnetometer has been built as a part of the research project "Determination of magnetic declination in Slovenia and comparison with global models of the earth magnetic field", started in 2007. The magnetometer is intended for long-term Earth magnetic flux density measurement. It includes a proton precession magnetometer and a three dimensional fluxgate magnetometer. The project is carried out by the Slovenian Research Agency and is funded by the Ministry of Defence.

GEOMAGNETIC MEASUREMENTS IN MACEDONIA

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ABSTRACT

From 2002 to 2004 the scientific team in the Department of Geology and the Geophysics at the Faculty of Mining and Geology Stip led by Dr. Jean Rasson (from the Royal Meteorological Institute - Geomagnetic Observatory in Dourbes, Belgium) developed the basic geomagnetic net of 15 measure points on the territory of the Republic of Macedonia. During 2003 and 2004 surveys were carried out on all measure points of the magnetic field (T, D, I). It was the first defining of the basic parameters of normal geomagnetic field in the territory of the Republic of Macedonia. Measurements were carried out with the equipment from the Observatory in Dourbes, Belgium.

The University "Goce Delcev", Stip which is currently in the process of amendments opens the possibility for establishing a Geomagnetic Observatory in the territory of the Republic of Macedonia.

So far, detailed measurements have been carried out on several localities in order to meet the requirements of INTERMAGNET for the determination of the site for the founding of the Observatory. It was determined the construction site to be in Mt. Plackovica.

THE REPRESENTATIVE RECENT SECULAR VARIATION OF THE GEOMAGNETIC FIELD ON CROATIAN TERRITORY

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ABSTRACT

The five consecutive geomagnetic surveys performed from 2004 to 2008 at Pokupsko repeat station, which is located in the central part of Croatia, were depicted. The static and RTK GPS methods for coordinate determination were investigated. The resulting geomagnetic field secular variation, and its time change, was chosen as being representative for the whole Croatian territory. In doing so, two models of data reduction using Tihany, as the closest reference geomagnetic observatory were considered. First data reduction model assumed simply that the secular variation at the repeat station and observatory were the same all the time throughout the year for which the annual mean was calculated. Second data reduction model took into the consideration the difference in secular variation at both repeat station and observatory for the concerned year. In addition, the reduction to a quiet level, according to procedure used at Edinburgh, and in reference to Tihany and L'Aquila observatories, was performed. All three reductions methods were compared. Obtained geomagnetic field values, as well as its secular variation were compared to those computed from the global geomagnetic models. In addition, Mokrovićs' historical data were used in order to determine the geomagnetic field variation. Herewith, the first geomagnetic field secular variation obtained from terrestrial surveys of the Republic of Croatia is presented.

Keywords: geomagnetic repeat station, geomagnetic data reduction, geomagnetic field secular variation

SITE SELECTION FOR PERMANENT OBSERVATION OF GEOMAGNETIC FIELD IN SLOVENIA

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ABSTRACT

This article presents the results of a site selecting methodology for permanent geomagnetic observation station in Slovenia. For this purpose different spatial data were used in GIS environment, which allowed the exclusion of sites with potentially very strong anomalies in magnetic field.

In order to determine the best candidate location additional practical criteria were used. Detailed measurements results in field anomaly at three potential locations were included in the site selecting process as well. The measurements results at these three locations and their distance from the artificial sources of interferences and changes in the Earth's magnetic field were analyzed in order to select the best location.

Keywords: GIS environment, site selection, permanent observation, geomagnetic field

GEOMAGNETIC MEASUREMENTS AT THE PREDMEJA REFERENCE STATION

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ABSTRACT

For the purpose of organizing and carrying out the first three-component measurements on site and the geomagnetic-field's vector change records on site in Slovenia, locations appropriate for such measurements/records have been selected on the basis of the detailed GIS monitoring of Slovenia and the characteristic analysis of the geological units in Slovenia. The positions of these locations and their distance from the artificial sources of changes & interferences in the Earth's magnetic field were additionally analysed in order to select proper locations.

The researchers at the Higher Education Centre, Sezana (VSS-Visokosolsko središče Sezana), Geomagnetic & Aeronomy Laboratory, in co-operation with the two researchers from the Grocka Geomagnetic Observatory (the Republic of Serbia) have carried out geomagnetic measurements & records at the 6000 Predmeja Reference Station on site and at the two repeat stations 6001 Kazlje (Kras) and 6002 Polje (Šentviska Planota). At the aforementioned stations a joint team of the researchers has carried out several types of geomagnetic measurements and testing: the testing of the geomagnetic-field's total-intensity gradient homogeneity, observations of the Sun's azimuth, the absolute, basic and three-component measurements of the geomagnetic field, and records of the geomagnetic-field's component diurnal-variations.

Keywords: geomagnetic measurements on site, Republic of Slovenia, absolute value, diurnal variation records

TELEMETRIC SYSTEM FOR GEOMAGNETIC FIELD MONITORING

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ABSTRACT

Measurements of changes in the geomagnetic field in Slovenia were concluded in 1989. They have been renewed through the scientific research project which began in August 2007. In line with this project it was necessary to define a location on the territory of the Republic of Slovenia which could be used as a starting point for geomagnetic

measurements. Such a location, chosen as the starting point for geomagnetic measurements in Slovenia, is expected to be the location for the construction of a Geomagnetic Station. The measurement results from this Geomagnetic Station would be collected and processed in a geomagnetic laboratory.

This paper describes the design and installation of a telemetric system for transmitting the measured geomagnetic field data to a distant laboratory in order to meet the INTERMAGNET's requirements of accuracy and timing. The described monitoring site was positioned in harsh environment with low and predictable magnetic interference, thus far from low-emitting communication infrastructure. Several issues had to be solved before the design of such a sensitive system began, including link reliability and availability, error prevention, detection and possible correction, data processing, temperature stability and low power consumption. A two-stage installed communication path consists of wired connection between magnetometer and embedded computer and the wireless part using commercial GSM/GPRS network.

Keywords: telemetric system, geomagnetic station, geomagnetic laboratory

MADU METHOD IN HEALING OF SPINAL OSTEOARTHRITIS SYNDROME

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ABSTRACT

Magnetotherapy with static magnetic fields presents the science of this fascinating subject, explaining why magnets increase oxygenation in the blood, lower cholesterol and blood pressure, reduce pain, enhance cellular and tissue regeneration.

The aim of this study is to show the new methods of application of the static magnetic fields for treating symptoms and signs of spinal osteoarthritis syndrome and weigh the benefits of special of north (N) pole oriented magnetic strips and magnetophores, in the contrast to traditional bipolar magnets.

We used static magnetic fields as a noninvasive method of the therapeutic application with magnetic deep unipolar [MADU- north (N) oriented] strips, as well as N oriented magnetophores, for treatment patients (103 males and females) with spinal osteoarthritis syndrome. Static magnets by their N pole faced were applied towards the skin with a power 10 to 15 times weaker than the tested and approved levels prescribe by the World Health Organization (WHO). The MADU strips applied on the reflexogenic zones, and magnetophores on the reflexogenic (acupuncture) points, retained contact with the body for a period ranging from three weeks to four years.

Followed period was from few months to four years. We examined 103 patients with spinal osteoarthritis syndrome follow-up according to radiological findings of regeneration which

had been found in 68 (66,02%) of the controlled patients; them 23 (22,33%) remained the same status, and 12 (11,65%) of patients were with disease progressed. Static magnetic fields was applied for extended periods of time in the form of magnetic strips (MADU) and (N) magnetophores, made a possible regenerative processes of the bone, bone cartilage and soft tissues in patients with spinal osteoarthritis syndrome, as a result of their influence on neural, vascular, enzymatic and metabolic processes in a joints. Special benefits is rehidratation of cartilage molecules with linked magnetized water. In that way spinal joint's function is increased.

EXPERIMENTAL MEASUREMENTS OF THE MAGNETISATION OF VARIOUS BIOLOGICAL SAMPLES

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ABSTRACT

At the Geomagnetic Institute, in the Laboratory for paleomagnetic and archeomagnetic research and at the Geomagnetic Observatory, Grocka (GCK) during the period from November 2004 to February 2008 the researchers carried out experimental magnetic measurements of the total-intensity gradient of the magnetic field vector (changes in the total magnetisation vector) of various biomaterials. Measurements of the total-intensity gradient of the magnetic field vector were carried out by GSM-19 magnetometers of high accuracy and recording resolution (accuracy: $\Delta F=0.1$ nT; sampling:1 sec). During these experimental biomagnetic measurements samples of water, tissue, blood, cotton, wool, pitch and magnetite-powder were used. In this study, the part of the biomagnetic measurement results relate to the blood & tissue bio-dispositive samples. The results of the measurements of the total-intensity gradient of the magnetic field for the biomaterial samples showed physical processes which are connected with the diamagnetic and paramagnetic properties of such biomaterials.

In addition to the results of the experimental biomagnetic measurements this study also presents the geophysical processes which define solar-geomagnetic activity disturbances (SGMA disturbances) and their analysis. These disturbances are occurrences of intensive solar flares and solar & magnetic storms. The changes in meteorological parameters are analysed for those months and days when the intensive solar & magnetic storms were recorded.

The results of the analysis of the changes in SGMA indices & meteorological parameters are applied in the process of research into the development of the metetropical weather situation. The way in which the changes in SGMA indices are induced in the structure of the metetropical weather situation is also analysed. The outcome of the metetropical

situation affects the dynamic and structure of changes in the biosphere. The objects in the biosphere (living/non-living substances, flora, fauna, humans, and so on) "feel/detect" the meteorological changes. The mechanisms of biomagnetic, magnetobiological biochemical and biophysical changes come into being in the biosphere.

USE OF ELECTRONIC INSTRUMENTS FOR DETECTION OF GEOPATHOGENIC RADIATION

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ABSTRACT

This document describes the use of instruments to detect geopathogenic radiation. The instruments have been developed by the firm Full-Point. They detect Hartmann and Curry geopathogenic radiation. These radiations are harmful to people, so the company has developed the protection named »biodispozitiv«, which can be used in order to reduce the impact of geopathogenic radiation.

Keywords: geopathogenic radiation, electronic detector, Hartmann, Curry, biodispozitiv.

ELECTROMAGNETIC HYPERSENSITIVITY EVALUATION IN PATIENTS WITH HYPERTHYROIDISM-NEUROHUMORAL EXAMPLE OF AUTONOMIC NERVOUS SYSTEM DISTURBANCES

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ABSTRACT

Physiological response to environmental stimuli causes non specific physiological changes, which are part of adaptation stress of living beings, in our case humans. The most common responses are: hormonal disorders, sweating, sleep disorders, cardiovascular disturbances, changes of mood, attention and cognition etc. Beside those, that are uneasy to measure in short time scale, there is a change of the electrical conductivity of the skin, caused by sweating and fluctuations in its electrical resistance. Those influences on the electrical conductivity of the human skin are mainly governed by Autonomic nervous system (ANS). The results of these reactions could be obtained and recorded as change in the electro-photographic readings of the surface of the body.

As characteristic and repetitive changes already occur in the pre-clinical stage of functional disturbances, the recordings of these disturbances could be used for additional diagnostic and epidemiological screening purposes in the case of certain diseases or hypersensitivity to environmental stimuli.

In order to use this method for diagnosis we must show in our experiment that a certain organic disturbance - hyperthyroidism in this case - is reflected by a change of electro-photographic emanations. Such pathological changes should occur regularly and be specific for the disease under investigation.

The aim of the research is to investigate, whether electro-photography could be consistently used to detect and measure stages of thyroid gland disease (hyperthyroidism). The main goal of the work is to assess the possibilities for early diagnosis of thyroid gland disease by the detection of the changes in the electrical resistance of the skin surface using a special form of electro-photography using the GDV-camera (Gas Discharge Visualization Camera).

CHANGES IN LATERAL PROTOCEREBRAL NEUROSECRETORY NEURONS OF *LYMANTRIA DISPAR* L. LARVAE AFTER THE EXPOSURE TO CONSTANT AND EXTREME LOW FREQUENCY MAGNETIC FIELD

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POSTER ABSTRACT

The neuroendocrine system of insects consists of neurosecretory neurons located in the brain and ventral nerve cord. Neurohormones are synthesized and secrete in neurosecretory neurons. Neurohormones represent the main regulators of physiological and metabolic processes including secretion of hormones that regulate molting, metamorphosis, reproduction, stress responses and homeostasis in insects. The dorsolateral neurosecretory neurons of insect protocerebrum are known to be a site of synthesis of allatostatins and large form of prothoracicotropic hormone, the regulators of metabolic and morphogenetic processes in insects.

The effects of constant magnetic (average magnet induction of 235 mT) and extreme low frequency (average magnet induction of 6 mT) magnetic field on morphometric characteristics of L2' neurosecretory neurons in 4th instar gypsy moth larvae were investigated. Larvae were reared from first until third day of 4th instar on artificial diet and in constant and extreme low frequency magnetic field.

The acute effect of constant magnetic field on morphometric characteristics of L2' neurosecretory neurons in gypsy moth larvae were not detected. The extreme low frequency magnetic field led to a decrease in L2' cells size. Both type of magnetic fields induced an increase in amount of neurosecretory material. After the exposure to constant magnetic field the neurosecretory material was medium size grained, while after the exposure to extreme low frequency magnetic field the large size grained neurosecretory material was dominantly presented. In this paper the reduction in L2' neurosecretory activity was obtained. It is known that these cells synthesize neurohormones involved in morphogenesis, and their level is decreased in the middle of larval instar and also when the instar is prolonged which be one of stress response action.

Keywords: L2' neurosecretory neurons, magnetic fields, gypsy moth

THE EFFECTS OF MAGNETIC FIELDS ON MORPHOMETRIC CHARACTERISTICS OF GYPSY MOTH MEDIAL NEUROSECRETORY NEURONS

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POSTER ABSTRACT

The effect of magnetic field on the physiology of neuroendocrine system and developmental processes in insects are poorly examined. Insect neurohormones which are master regulators of physiological, metabolic processes, homeostasis uphold, are mainly synthesized in neurosecretory neurons of protocerebral part of insect brain. The products of neurosecretory neurons in the medial part of insects' protocerebrum include neurohormones which participate in regulation of the synthesis of the main morphogenetic hormones.

The activity of protocerebral medial A2 neurosecretory neurons were investigated in 4th instar *Lymantria dispar* larvae, which were exposed to the acute effect of constant magnetic field (CMP) and extreme low frequency magnetic field (ELF MF). Larvae were kept for three days in constant magnetic field (average magnet induction of 235 mT) and extreme low frequency magnetic field (average magnet induction of 6 mT).

The size of A2 neurosecretory cells and the size of their nuclei were decreased after the exposure to ELF MF. Constant magnetic field induced the increase in number of A2 neurosecretory cells with high amount of large grained neurosecretory material. Our results indicate that ELF MF reduces the activity of A2 neurosecretory neurons, a possible location of the synthesis of insulin-like peptides, which have a role in control processes of moulting program, but probably also in stress response phase in which the energy for physiological reactions is obtained.

Keywords: A2 neurosecretory neurons, magnetic fields, *Lymantria dispar* L.

AGE-DEPENDENT EFFECTS OF MAGNETIC FIELD (50 HZ, 0.5 MT) ON MOTOR BEHAVIOUR AND STRIATAL NITRIC OXIDE PRODUCTION IN *MERIONES UNGUICULATUS*

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POSTER ABSTRACT

In the period of progressive technological development, artificial magnetic fields (MFs) including extremely low frequency (ELF) represent one of the important ecophysiological factors. Accordingly, possible consequences of just everyday exposure of biological systems to these MFs attracted many researchers attention. The purpose of this study was to investigate age-dependent effect of ELF-MF (50 Hz, 0.5 mT) on neurological parameters - motor behaviour and striatal nitric oxide (NO) production in *Meriones unguiculatus* (Mongolian gerbils). Animals (3.5, 10 and 20 months old) were continuously exposed to ELF-MF for 7 days. Motor activity and NO production were measured immediately after MF exposure, as well as three days after MF treatment (residual effect). Motor activity (locomotion and stereotypy) was registered in the "open field" and then analyzed by Any-maze software. In our study measure of locomotion was distance traveled in meters, while measure of stereotypy (such as sniffing, self-grooming, licking, and head waving) was distance traveled in meters by animal's head. Index of NO production was estimated by nitrate and nitrite determination, which are the first stable metabolites of NO in striatum - brain structure involved in control of motor behaviour. It was shown that ELF-MF-induced changes in motor activity and striatal NO production are age-related in *Meriones unguiculatus*, with the most pronounce effect in 3.5 months old animals. These alterations are particularly intensive immediately after termination of exposure to ELF-MF for 7 days and gradually disappear in time. In conclusion, ELF-MF has obvious age-related modulatory effect in animals, which could be explained by morpho-physiological changes during aging.

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MAGNETIC TRAP - NONINVASIVE REPLACEMENT OF FERROUS BODIES FROM ORGANISM

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POSTER ABSTRACT

Magnetic trap is ecological medical device, for noninvasive treatment and replacement of ferrous bodies from organism, that can be applied as a additional therapy, along with other contemporary ways of curing. What is unique for magnetic trap is the usage of magnetic unipolar oriented field, as a type of energy that is similar to biophysical mechanisms of live beings and allows principal changes in organism on which local and distant therapeutical impacts are founded. These impacts are interpreted and resolved through well known physiological and pathophysiological mechanisms.

Magnetic field, produced by application of magnetic trap, belongs to one of three central forces in nature - permanent magnetism and represents new health technology. It is applied on the surface of the body with its north node and it's worn in individual estimated time interval until the achievement of satisfied results.

By stimulation of respective acupunctural points, beside the replacement of ferrous parts, spasmolytic and antidolorous effects were achieved simulatenously. In this paper we are going to present the effects and results of applied magnetic trap through ceratin case studies.

Magnetic trap is medical device, approved in 2000. and is a new medical technology based on the influence of permanent magnetic field and succesefully used for evacuation of ferrous bodies from organism

Keywords: magnetic trap, ferrous bodies, new medical device

EFFECTS OF MAGNETIC FIELDS ON ACTIVITY OF SUPEROXIDE DISMUTASE, CATALASE AND TOTAL GLUTATHIONE IN *BACULUM EXTRADENTATUM* B

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POSTER ABSTRACT

Current scientific literature makes it apparent that the magnetic field represents a very important environmental factor. The effects of the magnetic field on physiological and biochemical processes have been reported mainly in higher organisms, but the effects on these processes in insects are poorly examined. Magnetic fields can initiate number of biochemical and physiological alterations in cells. It can affect increase of free radical production and modulate antioxidative defense and it can be one of the possible mechanisms of magnetic field effects on biological systems.

The aim of our work was investigation of activity of superoxide dismutase, catalase and total glutathione in hemimetabolous insect *Baculum extrudentatum*, which was developed in constant magnetic field (320 mT) and intermittent magnetic field (50 Hz, 6 mT). Our results show significant increase of superoxide dismutase and catalase activity in individuals treated with intermittent magnetic field. Constant magnetic field significantly increase superoxide dismutase activity, while glutathione amount tend to increase in individuals treated with both, constant and intermittent magnetic fields. Our results indicate that both constant and intermittent magnetic fields exposures change antioxidative defense in *Baculum extrudentatum*.

THE 400 YEARS OF RESEARCH INTO EARTH'S MAGNETIC FIELD

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POSTER ABSTRACT

The experimental work which established the groundbreaking statement - that the Earth is a magnet - made by William Gilbert in 1600, is regarded as the beginning of research into geomagnetism. Some decades later the geomagnetic-field's secular variation phenomenon was observed by Henry Gellibrand and the geomagnetic-field's diurnal variation phenomenon was observed by George Graham; these phenomena disprove the earlier opinion that the Earth is a permanent magnet.

At the beginning of the 19th Century, Alexander von Humboldt was driving force behind the establishment of many geomagnetic observatories around the world with the aim of observing the geomagnetic field systematically. In addition, he attracted Carl Friedrich Gauss and his co-worker Wilhelm Weber to undertake research into geomagnetism. They introduced the absolute measuring method, and Gauss also set up the basis for mathematical analyses of the geomagnetic field, which was established on the basis of the work done by Charles Coulomb and Simeon Denis Poisson. James Clerk Maxwell was another giant name among the researchers, who also made a major contribution to geomagnetic research with his electromagnetic field theory. At the end of the 19th Century Gauss' analysis and Maxwell's electromagnetic theory enabled rapid developments in geomagnetic research.

In 1919, Joseph Larmor published a paper stating that sunspots might result from a self-sustaining dynamo mechanism. In the middle of the last century, on the basis of that idea, Walter Elsasser developed the Earth's dynamo model, which was later supplemented by

Stanislav Braginsky. Thus, he laid the foundation for the theory/model of the source of the geomagnetic field, from which the so-called alpha-omega-dynamo model arose which is today the most widely accepted model. This model also allows for geomagnetic pole reversal, as the magnetic north and south have switched places in the ancient past of the earth several times; the last one happened approximately 780,000 years ago. Bernard Brunhes first reported on geomagnetic pole reversal in 1906, which he observed on the basis of measurements of the magnetic field in volcanic rock (magnetite).

Keywords: geomagnetic measurements, history

CROATIAN GEOMAGNETIC NETWORKS

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POSTER ABSTRACT

Geomagnetic networks in Croatia consist of the repeat stations network, and the part of network for field mapping nowadays. The Croatian Geomagnetic Repeat Stations Network was established in 2004. Herewith, the setup of two additional repeat stations in 2008 is described. Lessons learned during the the repeat station surveys of 2004, 2007, and 2008 are revealed. The design of the dense Croatian Geomagnetic Network for Field Mapping, that is to consist of approximately 90 stations with the average distance from one station to another of 25 km, is presented. The setup and the survey of the first third of the network, covering the southern Dalmatia, including islands, was completed in summer 2008. The instruments and procedures used, as well as the experiences gained are described. In addition, the attempts to determine the total intensity of geomagnetic field on the Adriatic volcanic islands of Jabuka and Brusnik are presented.

Keywords: geomagnetic repeat station network, geomagnetic network for field mapping, geomagnetic surveys

GEOMAGNETIC FIELD IN CROATIA - THE NEW RESULTS

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POSTER ABSTRACT

After more than 50 years the measurements of the geomagnetic field in Croatia have been renewed. During the time interval 2003-2005 a ground survey of total magnetic field intensity in the middle northern part of Croatia has been performed. Measurements were reduced to the epoch 2004.5 using records from AQU, FUR, NCK and THY observatories. The special effort was done to understand the uncertainty and errors in data reduction. This can be done by a comparison between the two or more observatory time sequences, when one of the observatories is used as a reference one, with known annual mean values of the total field at all observatories. For the secular variation over the investigated area we have used the first order Taylor polynomial over geographic coordinates, and the secular variations at observatories were calculated by using the monthly mean values. The normal total field has also been estimated by means of first-order Taylor polynomial as function of the geographic coordinates. The polynomial coefficients were calculated by multilinear regression with three methods of adjustment: simple and weighted least squares fit and adjustment according to the most frequent value. Each adjustment was tested using the Monte Carlo-type stability tests. In order to obtain the distribution of the anomaly field, the core contributions as predicted by the global model were subtracted from the calculated normal field. The present study gives the first detail distribution of the total field intensity, as well as the anomaly field over middle northern part of Croatia.

Keywords: ground survey, data reduction, normal geomagnetic field, normal field anomalies

THE USE OF SECULAR AND PALEOSECULAR VARIATION OF THE GEOMAGNETIC FIELD AS A DATING TOOL FOR VOLCANIC ROCKS: LESSONS LEARNED FROM STROMBOLI VOLCANO (ITALY)

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POSTER ABSTRACT

Detailing the eruption ages for the last few centuries or millennia is fundamental to constrain the future hazard for a given volcano, as eruptions are often framed into repetitive "volcanic cycles", displaying similar characteristics both in terms of types and timing of eruptions. At Stromboli, only a volcanic unit yields a K/Ar age younger than 10,000 yr BP. For the Holocene volcanics, the ^{14}C method is routinely used to constrain the eruption ages, by dating soils located below and above given volcanic deposits. Yet soils (datable by ^{14}C methods) hardly develop if the eruption rate is high.

Paleomagnetic dating method may represent in principle the most powerful dating tool for recent (i.e. up to few kyr ago) volcanics from the Mediterranean domain. Paleomagnetic directions gathered from the exposed volcanics are compared to relocated reference directions from given age windows, derived from independent reference curves of the secular (SV) and paleosecular variation (PSV) of the geomagnetic field.

In order to provide dating, we have built an “ad-hoc” SV-PSV reference curve for the Mediterranean domain, merging several geomagnetic, archeomagnetic, and paleomagnetic data sets from Europe, and relocating all data to Stromboli, by virtual geomagnetic pole method. Concerning the last four centuries, we have considered historical measurements of the geomagnetic field direction made in Italy and France since 1640 AD. Original ages were modified taking into account a $0.38^\circ/\text{yr}$ westward drift of the geomagnetic. For older ages, there are several valuable archeomagnetic data sets from the last two-three millennia gathered from several European countries, i.e. Great Britain, France, Germany, Italy, and Bulgaria. Among them, we selected (for the last three millennia) the French data set, which is based on a greater number of data than the others, and has been also already compared to paleomagnetic data collected from several Italian volcanoes. For periods older than the last two millennia, the fundamental PSV reference curve is represented by the Bulgarian archeomagnetic curve, extending back to ca. 8000 yr BP. We also considered two relocated curves derived from the paleomagnetism of lake sediments: the UK Holocene master curve and Fennostack. The former represents the stack of paleomagnetic directions gathered from ten cores drilled in three lakes from Great Britain. The composite SV-PSV curve built for the Mediterranean domain yielded an unprecedented high-resolution detail of the Holocene eruptive history of Stromboli. Our synthetic SV-PSV curve now made available will represent a first-order standard to use paleomagnetism as a dating tool, and provide high-resolution dating for other volcanoes from the Mediterranean domain.

OBSERVATIONS OF THE GEOMAGNETIC FIELD DAILY VARIATION AT MARIO ZUCHELLI STATION, ANTARCTICA

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POSTER ABSTRACT

During the 1986-87 austral summer a geomagnetic observatory was installed at the Italian Antarctic Base Mario Zucchelli Station (formerly Terra Nova Bay; the base changed its name in 2004; international geomagnetic observatory code TNB; geographic coordinates: 74.69S, 164.12E; LT=UT+13; geomagnetic coordinates: 80.0S, 307.7E; magnetic local time MLT=UT-8). In the first three years the measurements of the geomagnetic field were carried out only during summer expeditions. Since 1991 an automatic acquisition system, operating through all the year, was put in operation. In this work we show some peculiarities of the daily variation as observed at TNB over twenty years, from 1987 to 2006. The availability of a long series of data has allowed the definition of seasonal, as well as solar cycle, effects on daily variations as observed at a cusp-cap observatory. Also a comparison of daily variation with observations at other Antarctic observatories (Dome C and Dumont D’Urville) located at different positions within the polar cap, is shown.