Romanian Academy
"Sabba S. Ştefănescu" Institute of Geodynamics

THE ANNUAL SCIENTIFIC SESSION OF THE INSTITUTE OF GEODYNAMICS

PROGRAMME AND ABSTRACTS

January 9–10, 2014

Scientific and organizing committee:

Dr. Crişan Demetrescu
Corresponding member of the Romanian Academy

Dr. ing. Dumitru Stănică

Dr. ing. Lucian Beşuţiu

Dr. Mihai Tatu

Dr. Venera Dobrică

Dr. Ioan Seghedi

Dr. Lidia Nuţu

Gabriela Ioane – Technical support

PROGRAMME

THURSDAY, JANUARY 9, 2014

$10 – 10^{15}$
Crişan Demetrescu –
Rezultatele evaluării activităţii *Institutului de Geodinamică* pe anul 2013

Convener: Mihai Tatu

$10^{15}–10^{35}$
Ion Berbeleac, Mădălina Vişan, Luisa-Elena Iatan – The role of preexisting geologic architecture in the formation of Neogene porphyry-related Cu–Au (Mo), gold and gold-bearing mineralizations from Voia Metaliferi Mountains

$10^{35}–10^{55}$
Maria-Lidia Nuţu – Fluid circulation along microfracture systems from Subcarpathian Nappe domain during post-collision stage (11–0 Ma)

$10^{55}–11^{15}$
Ioan Seghedi, Alexandru Szakács, Răzvan-Gabriel Popa, Cristian G. Panaiotu, Zoltan Pecskay – Revised space-time evolution of monogenetic volcanism in Perşani Mts

$11^{15}–11^{35}$
Răzvan-Gabriel Popa, Ioan Seghedi, T. Ntaflos, Zoltan Pecskay – Evolution of Caraci volcano, South Apuseni Mts. Geodynamic significance

$11^{35}–12^{05}$ – **COFFEE BREAK**

Convener: Venera Dobrică

$12^{05} – 12^{25}$
Cristiana Ştefan – Characteristics of the radial component of the geomagnetic field at core surface

$12^{25}–12^{45}$
Răzvan Greculeasa, Venera Dobrică, Crişan Demetrescu – Sources of the geomagnetic activity as seen in European geomagnetic records

$12^{45}–13^{05}$
Aura-Cristiana Pătroi – Magnetic structures as derived from the diurnal variation of the geomagnetic field recorded by Asian observatories

13^{05}–13^{25}
Georgeta Muntean – High speed streams in the solar wind for solar cycle 24

13^{25}–14^{05} – **BREAK**

Convener: Georgeta Muntean

14^{05}–14^{25}
Venera Dobrică, Crişan Demetrescu – On the evolution of magnetosphere and ionosphere current systems as seen in geomagnetic indices

14^{25}–14^{45}
Crişan Demetrescu, Cristiana Ştefan, Venera Dobrică – Geoeffective solar activity before geomagnetic observatory era. Insights from global models of the geomagnetic field

14^{45}–15^{05}
Diana Ionescu – Solar eruptive phenomena with seismic and geodynamic consequences

15^{05}–15^{25}
Daniela Adriana Lăcătuş, Alin Răzvan Paraschiv – CMEs causing geomagnetic storms in the period 2007–2011

FRIDAY, JANUARY 10, 2014

Convener: Ioan Seghedi

10^{00}–10^{20}
Lucian Beşuţiu, Luminiţa Zlăgnean, Ligia Atanasiu, Raluca Brezeanu-Focşăneanu – Complex research on the connections between internal geodynamic processes and seismicity within SE Carpathians and related foreland

10^{20}–10^{40}
Luminiţa Zlăgnean – Geodynamic monitoring of Peceneaga–Camena Fault, Başpunar Observatory

10^{40}–11^{00}
Raluca Brezeanu-Focşăneanu – A computer code for automatic processing of the Başpunar Observatory records

11^{00}–11^{20}
Nicoleta Cadicheanu – Phase variations of the amplitude for the M2 Earth tide component at the level of the geodynamic observatories from Romania

11^{20}–11^{50} – **COFFEE BREAK**

Convener: Dumitru Stănică

11^{50}–12^{10}
Enrico Brandmayr, Maria Tumanian – Seismological, density and thermal modelling of active tectonic areas: examples of application to Italy and preliminary results for the Carpatho-Pannonian Region (CPR)

12^{10}–12^{30}
Mirela-Adriana Anghelache, Nicoleta Cadicheanu, Horia Mitrofan – Intermediate-depth Vrancea events with fault-plane solutions striking NW-SE. Possible geodynamic significance

12^{30}–12^{50}
Horia Mitrofan, Cornelia Marin, Mirela-Adriana Anghelache, Mădălina Vişan, A. Tudorache, Florina Ţuluca – A possible structural control on the areal distribution of mineral water discharges "sensitive" to significant Vrancea earthquakes

12^{50}–13^{10}
Marian Popescu – Analysis of geomagnetic signal associated with seismic events

13^{10}–13^{40} – **BREAK**

Convener: Lucian Beşuţiu

13^{40}–14^{00}
Dumitru Stănică, Dragoş-Armand Stănică – Possible correlation between the pre-seismic anomalous behaviour of the normalized function Bzn and the intermediate-depth earthquakes – Vrancea zone

14^{00}–14^{20}
Dumitru Stănică, Dragoş-Armand Stănică, Nicoleta Vladimirescu – M9 great Tohoku earthquake and its global pre-seismic geomagnetic effect

14^{20}–14^{40}
Lucica Niculae – The indirect assessment of river-torrential erosion by determining the volume of material removed from the Lepşa morphohydrographic basin

14^{40}–15^{00}
Florin Munteanu, Dorel Zugrăvescu, Constantin Udrişte – Nonlinear approaches in experimental geodynamics

15^{00}–15^{20}
Valentin Constantin Furnică – Some cosmic phenomena possibly responsible for seasonal variations of electrode potential differences measured in laboratory conditions

INTERMEDIATE-DEPTH VRANCEA EVENTS WITH FAULT-PLANE SOLUTIONS STRIKING NW-SE. POSSIBLE GEODYNAMIC SIGNIFICANCE

MIRELA-ADRIANA ANGHELACHE[1], NICOLETA CADICHEANU[2],

HORIA MITROFAN[3]

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Intermediate-depth Vrancea earthquakes display fault-plane solutions having both nodal planes striking either NE–SW, or NW-SE, in a thrust deformation regime with vertical extension and horizontal compression. The fault-plane solutions striking NE–SW, which corresponded to all the instrumentally recorded Vrancea events with Mw ≥ 6.5 (Nov 10, 1940; Mar 4, 1977; Aug 30, 1986; May 30, 1990), have been widely investigated. In contrast, in terms of the overall seismic regime of the Vrancea zone, earthquakes with fault-plane solutions striking NW–SE appeared to be of a smaller interest. It was felt necessary to perform a detailed inventory of the Vrancea earthquakes with NW–SE striking fault-plane solutions, in order to assess their potential specific impact on the overall seismic hazard of that region. By Gutenberg-Richter analysis there was revealed that in the group of earthquakes with fault plane striking NW–SE there are included far fewer earthquakes of high magnitude compared to the group of earthquakes with fault plane striking NE–SW. In addition, earthquakes with fault plane striking NW–SE release - overall - much less energy than Vrancea earthquakes with seismic fault plane striking NE–SW. Differentiation between the two types of earthquakes is visible in terms of maximum magnitude determined for the most powerful earthquakes recorded instrumentally: M_w = 6.6 for those with fault plane striking NW–SE versus M_w = 7.7 for ones with fault plane striking NE–SW.

THE ROLE OF PREEXISTING GEOLOGIC ARCHITECTURE IN THE FORMATION OF NEOGENE PORPHYRY-RELATED CU – AU (MO), GOLD AND GOLD-BEARING MINERALIZATIONS FROM VOIA METALIFERI MOUNTAINS

ION BERBELEAC[1], MĂDĂLINA VIŞAN[2], LUISA-ELENA IATAN[1]

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[2]Electromagnetism and Dynamics of Lithosphere Department

The major preexisting geologic architectures with implications in the formation of Neogene porphyry-related Cu-Au (Mo), gold and gold bearing mineralizations from Voia area were the followings: the crustal faults, the thrust and nappe structures, the nature and geometry of pre extension-compression events. The main results of Voia diamond drillings and magnetotelluric sounding projects, accompanied by field mappings and laboratory studies consist in: 1) the presence of ~ E–W crustal faults up to 5 km depth; 2) on 5 km depth the crustal faults cut and divide the structure in four blocks, each of these, except the fourth block, roughly comprises five layers relived by resistivity contrasts; 3) nappe structure, represented by Ardeu (J_2–K_1 limestones), Techereu – Drocea (J ophiolite + island arc volcanic rocks), between ~1–3 km depth) and Precambrian-Paleozoic crystalline schists of Biharia nappes, situated between ~3–5 km; 4) mini-shallow magma chambers hosted by crustal faults especially situated at the fault intersections with thrust flat planes. The shallow magma chambers have been the place of temporary stopping magmas, mixing and segregation of magmas, forming the hybride rocks, and magmatic-hydrothermal ore fluids; 5) a composite HS "blind" porphyry Cu-Au (Mo), Ca-Mg – pyrite skarn body, As-Cu (Au) veins, quartz-pyrite-Au "vuggy" breccia and pyrite-anhydrite (gyps) and IS and LS gold-base metal sulfides mineralization and, 6) Sarmatian–Pannonian magmatic-hydrothemal mega system with about 3–4 Ma time-space evolution, possible formed from other 1–2 "blind" porphyry-Cu-Au (Mo) systems located in the upper part of Voia Valley, and 7 volcanic structures arranged in circle and central part in collapse and pull-apart and graben structures. The system evolution begins with hornblende-biotite±pyroxene Qtz-K andesites of Săcărâmb and Cetraş types, products from Măcriş, Coasta Mare, Geamăna, Paua, Momeasa, Cetraş and Buha volcanoes. Between Buha and Măcriş volcanoes, the outcrops with the layering hydride rocks which represent a succession of grey and white colors, with tephrite-phonolitic textures. The outcrops comprise numerous folds, with centimetric sizes and highly deformed. The white color is specific to acid rocks – like dacite, the grey color indicate an andesitic composition. Probably, these rocks are the result of the mixing between basaltic and acide magmas.

COMPLEX RESEARCH ON THE CONNECTIONS BETWEEN INTERNAL GEODYNAMIC PROCESSES AND SEISMICITY WITHIN SE CARPATHIANS AND RELATED FORELAND

LUCIAN BEŞUŢIU, LUMINIŢA ZLĂGNEAN, LIGIA ATANASIU, RALUCA BREZEANU-FOCŞĂNEANU

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Recent crustal earthquakes (EQs) within the Galaţi–Izvoarele area, followed by intermediate-depth seismic events within Vrancea zone have considerably raised the interest of the both specialists and large audience on the unusual seismicity of the eastern Moesian Plate (MoP) and the still debated Vrancea intermediate-depth EQs. Both crustal events in stable craton areas and the intermediate-depth seismicity within full intra-continental environment may be hardly included in current tectonic and geodynamic models. Several questions need to be answered such as: (i) what is the origin/genesis of crustal and sub-crustal EQs; (ii) are crustal events connected to the oil explorations in the region?; (iii) are crustal events in front of Carpathians connected in any way to the intermediate-depth EQs of the Vrancea zone? and so on. The paper aims at explaining these unusual phenomena based on an alternative geodynamic model for the bending zone of East Carpathians and their related foreland. It starts from the assumption that tectonic and geodynamic setting of the above-mentioned area have been strongly influenced by the opening of the W Black Sea basin that, among the others, split the MoP into several tectonic compartments, and created within the bending zone of East Carpathians an unstable triple junction. A special research infrastructure for geodynamic monitoring of the area has been implemented and exploited by the Solid Earth Dynamics Department in order to study the eventual connection between changes in tectonic forces (as revealed by the monitoring network) and changes in the crust and upper mantle seismicity within the study area. Through its gravity and geodetic consequences, the recent EQs swarm in the Galaţi–Izvoarele area seems to validate the suggested geodynamic model.

SEISMOLOGICAL, DENSITY AND THERMAL MODELLING OF ACTIVE TECTONIC AREAS: EXAMPLES OF APPLICATION TO ITALY AND PRELIMINARY RESULTS FOR THE CARPATHO-PANNONIAN REGION (CPR)

ENRICO BRANDMAYR[1], MARIA TUMANIAN[2]

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A 3D cellular model of the crust and upper mantle of the central Mediterranean is presented offering a geodynamic interpretation in the framework of the global asymmetry theory of plate tectonics. The cellular model is expressed in terms of shear waves velocity (V_S), thickness and density of the layers, to a depth of 350 kilometers. These physical properties are obtained by means of advanced non-linear inversion techniques, such as the "hedgehog" inversion method of group and phase velocity dispersion curves for the determination of V_S and the non-linear inversion of gravity data by means of the method GRAV3D. The "hedgehog" method allows the definition of a set of structural models without resorting to any a priori model, considering the V_S and the thickness of the layers as independent variables. Given the well-known non-uniqueness of the inverse problem, the representative solution of each cell is determined through the application of optimization algorithms and is also validated with the use of independent geological, geophysical and petrological data, *e.g.* the distribution of historical and recent seismicity, obtained from international bulletins and by non-linear inversion of focal mechanisms. The gravimetric inversion has been constrained to the geometry of the layers defined by the V_S model obtained from the inversion of seismological data. To the gravimetric data input a Gaussian noise with an amplitude of 1.5 mGal has been applied. In order not to impose a priori the existence of the density decreases with increasing depth, the reference density model used in the inversion consists, for all the cells, in a model of increasing or at least constant density with depth, which satisfies, within the range of uncertainty, the Nafe-Drake relation. The density anomalies obtained by the gravimetric inversion process are then transformed into absolute values relative to the reference model. The model analysed and discussed along selected sections perpendicular to the orogenic complexes of the study area (Apennines, Alps, Dinarides) confirms the existence of deep structural asymmetries between E- and W-directed subductions and the presence of a thin lithosphere in the extensional area of the Tyrrhenian basin, which overlies a low velocity zone (LVZ) indicative of the presence of large amount of magma or partial melting, where an eastward mantle flow is likely present. This flow possibly causes the asymmetry found between the almost vertical Apenninic subduction and the Alpine-Dinaric subduction, which is in turn characterized by a low dip angle. Further and unexpected feature of the model is the fact that the subducting lithosphere turns out to be less dense than the surrounding mantle. A thermal model along the same profiles is presented, obtained by a conversion technique of V_S to temperature and developed in cooperation with the Institute of Geodynamics of the Romanian Academy. Some preliminary results of V_S and thermal modelling of the upper mantle in the CPR are as well presented for discussion.

A COMPUTER CODE FOR AUTOMATIC PROCESSING OF THE BASPUNAR OBSERVATORY RECORDS

RALUCA BREZEANU-FOCŞĂNEANU

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The need for an appropriate tool aimed at automatic data processing came with the increasing amount of information acquired at Başpunar Geodynamic Observatory (BGO) – as part of the research infrastructure developed by Solid Earth Dynamics Department for monitoring crust deformation along the Pecenaga–Camena Fault. Records provided by one of the two total stations of BGO may daily reach up to 1440 geodetic information vectors, each of them consisting of several elements (*e.g.* slope and horizontal distances between total station and laser reflector, horizontal and vertical azimuths, and the time label), to which atmosphere parameters (air temperature and air pressure, relative humidity, etc.) recorded by the BGO weather station are added. This large amount of data needs to be accurately and quickly processed. A secure way to accomplish the task requires an adequate computer code. The script is written in *bash* (Linux) and it takes the original files (total station registered data and meteorological data) in a .txt format, corrects and combines the two, calculates different parameters and pulls out a complete .txt file – that can be easily exported in Excel format – and builds up graphs for results visualization. The utility of the script can be translated in a less time consuming operation, and in a way to prevent any failures that are accidentally done by a human operator due to the large amount of data to work with. The processing time is reduced up to 1–2 minutes per fully recorded day. The tests that we ran have proved that the script can handle most of the unforeseen situation (missing data, bad recordings) without introducing errors. With the Unix-like environment installed (CigWin and MinGW) on a Windows PC, the script can be easily used by whoever user.

PHASE VARIATIONS OF THE AMPLITUDE FOR THE M2 EARTH TIDE COMPONENT AT THE LEVEL OF THE GEODYNAMIC OBSERVATORIES FROM ROMANIA

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Earth tides are an important natural phenomenon which causes periodical variations in the gravitational field and deformations of the Earth's interior and Earth's surface. Measurements of the Earth tides provide information on the elastic constants of the Earth (Love numbers). In contrast to Earth tides, which can precisely be computed, earthquakes are almost unpredictable although some investigations have shown that the elastic properties of rocks may change before earthquakes occur. If the elastic properties of rocks could be monitored it would be, in principle, possible to contribute to earthquake precursory research. Some parameters of earth tides, as amplitude and phases of their components, are directly related to the elastic properties of rocks. Through the modeling and systematic observations of earth tide parameters related to rock elasticity it should be possible to detect precursors of earthquakes. As measurements of the deformation of the Earth are generally complex functions of the direct response of the Earth to the deforming forces combined with instrument response, local and regional loading and crustal structure, finding of the most appropriate method able to provide information about variations of the elastic properties of rocks remains a difficult challenge. We have chosen to monitor the phase variations of the amplitude for the M2 Earth tide component at the level of the geodynamic observatories from Romania. This is a first step to understand the possible relation between the temporal variations of M2 phase and other local and global important geophysical phenomena (tectonically processes, seismic precursors, etc.). Our methodology is based on HiCum methods applied in sliding windows on the time series of gravimetric and tilt records.

GEOEFFECTIVE SOLAR ACTIVITY BEFORE GEOMAGNETIC OBSERVATORY ERA. INSIGHTS FROM GLOBAL MODELS OF THE GEOMAGNETIC FIELD

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It has been known for a long time that geomagnetic observatory annual means are contaminated by external effects, due to incomplete averaging out of the recorded geomagnetic activity. We show that the external contribution leaks into global main field models based (mainly) on ground observations (geomagnetic observatories and prior geomagnetic measurements taken during sea voyages). We assess its evolution in case of *gufm1* (Jackson *et al.*, 2000) that covers a long time span (1580–1980) and model it in terms of geomagnetic activity as described by *aa*, the longest time series geomagnetic index. The evolution of external effects in *gufm1* can be traced to 1600 and provides valuable information on the geomagnetic activity prior to observatory era (~1870). Its magnitude is significant even during the Maunder Minimum of the solar activity.

ON THE EVOLUTION OF MAGNETOSPHERE AND IONOSPHERE CURRENT SYSTEMS AS SEEN IN GEOMAGNETIC INDICES

VENERA DOBRICĂ, CRIŞAN DEMETRESCU

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The evolution of several magnetospheric and ionospheric current systems at interannual and interdecadal timescales is discussed. A number of geomagnetic indices have been designed to describe this evolution and variability – a consequence of the interaction of the solar wind and heliospheric magnetic field with the magnetosphere and ionosphere. The correlation between pairs of indices (aa, AE, Dst, PC) at various time scales, from hours to interdecadal, shows the increasing overall effect of long-term solar activity on the magnetosphere variability. The long-term behavior of these indices is characterized by solar activity signature at Hale and Gleissberg timescales. An attempt is made to reconstruct these indices back to 1870.

SOME COSMIC PHENOMENA POSSIBLY RESPONSIBLE FOR SEASONAL VARIATIONS OF ELECTRODE POTENTIAL DIFFERENCES MEASURED IN LABORATORY CONDITIONS

VALENTIN CONSTANTIN FURNICĂ

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Situations created by the differing tilts of the rotation axes of the Sun and Earth with respect to the ecliptic, assuming that both bodies posses their own magnetic fields, lead to the existence of two time intervals, equivalent to the warm and cold seasons in the northern hemisphere, between March 21 and September 21. These can be divided in ~ 3 months intervals, if one takes into account the dates 6/7 April and 10/11 October, when the Earth should enter in the domain of the solar magnetic field with opposite sign, traveling through positive field values with a maximum on July 7 and through negative field values with a maximum on January 5/6, for the case when the magnetic vector coincides with the Sun's rotation axis, pointing above the ecliptic. Following the variations due to the eccentricity of the Earth's orbit, the time intervals October 27/28 – November 9/10 (13–14 days) and February 4/5 – February 18/19 (14–15 days) in the cold season, or May 3/4 – May 24/25 (21–22 days) and July 14/15 – August 5/6 (22–23 days) in the warm season, could become important as it moves around the Sun, in the hypothesis that Earth would have its own electrical charge.

SOURCES OF THE GEOMAGNETIC ACTIVITY AS SEEN IN EUROPEAN GEOMAGNETIC RECORDS

RĂZVAN GRECULEASA, VENERA DOBRICĂ, CRIŞAN DEMETRESCU

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The disturbance geomagnetic field recorded at European observatories in the time interval 1–10 August 2010 is studied and discussed in terms of the effect of the auroral electrojet and magnetospheric ring current. The two current systems form as a result of the solar wind and heliospheric magnetic field interaction with magnetosphere and ionosphere, and are represented by the AE and, respectively, the Dst index. A moderate geomagnetic storm (Dst min = - 70 nT) occurred in the study interval (August 3–4), with is recovery phase spanning to August 10. Data were processed to show the disturbed variation by subtracting a mean diurnal solar quiet variation inferred from the recordings in the five quietest days of the month.

SOLAR ERUPTIVE PHENOMENA WITH SEISMIC AND GEODYNAMIC CONSEQUENCES

DIANA IONESCU

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Solar flares are spectacular eruptive phenomena with consequences both in the photosphere and in the heliosphere. Sunquakes (Kosovichev & Zharkova, 1998) are one of the most recent discovered consequences on the photospheric level. Acoustically active solar flare analysis can reveal insights about the solar interior. On the opposite side, flares can cause chromospheric waves and can be correlated with coronal mass ejections. I will present an analysis of a sunquake from 2011 triggered by the X2.2-class solar flare (start - 01:44 UT, max - 01:56, end - 02:06 UT) from February 12. This flare took place above the active region NOAA 11158 (S21W28; 417", -433") of (Hale) magnetic classification $\beta\gamma$. The analysis will comprise the study of the seismic source's evolution and a comparative study over multiple wavelengths showing the characteristics of the solar atmosphere during this flare.

CMEs CAUSING GEOMAGNETIC STORMS IN THE PERIOD 2007–2011

DANIELA ADRIANA LĂCĂTUŞ, ALIN RĂZVAN PARASCHIV

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Coronal mass ejections (CMEs) in the period 2007-2011 which were directed towards Earth and produced geomagnetic storms (Dst < -30 nT) have been selected. Data from the SECCHI-COR2 coronagraphs on-board the STEREO mission was used, in order to derive the true speeds and direction of propagation of these CMEs. We have used different 3-dimensional reconstruction methods (Forward modeling technique; Local correlation tracking and triangulation; Polarized ratio technique) on these events in order to derive their 3D parameters (direction of propagation, angular width, orientation etc.). Using the forward modeling technique, we have obtained the true propagation speed and compared the value with the speed of the CME as seen from LASCO and with the speed of the ICME when they reached Earth, as measured by ACE.

A POSSIBLE STRUCTURAL CONTROL ON THE AREAL DISTRIBUTION OF MINERAL WATER DISCHARGES "SENSITIVE" TO SIGNIFICANT VRANCEA EARTHQUAKES

HORIA MITROFAN[1], CORNELIA MARIN[2], MIRELA-ADRIANA ANGHELACHE[1], MĂDĂLINA VIŞAN[1], A. TUDORACHE[2], FLORINA ŢULUCA[1]

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There are documented several mineral water discharges which, on occurrence of significant Vrancea mantle depth (60–180 km) earthquakes, displayed a particular type of geochemical signature. The areal distribution of the corresponding groundwater sampling sites indicates that they are all positioned close to the outer border of a domain with increased seismic velocities, outlined by previous tomographic studies at crustal depths (beneath 4 km, and down to at least 15 km). Additional geophysical evidence indicated that, in fact, that particular structure seemed to extend, virtually vertically, down to about 130–50 km depth, where it merged with the "fast" mantle-depth body which had been unanimously ascribed to the "slab" hosting the Vrancea earthquakes. Long-range interactions could hence operate in this region over lithospheric domains which extended, on the vertical, for at least 100 km.

HIGH SPEED STREAMS IN THE SOLAR WIND FOR SOLAR CYCLE 24

GEORGETA MUNTEAN

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The high speed streams in the solar wind, by their content of energetic solar particles, provide an enhanced energy transfer from the solar wind/heliospheric magnetic field system into the Earth magnetosphere and initiate geomagnetic disturbances. A series of catalogues (Lindbald and Lundstedt, 1981, 1983, 1989, Mavromichalaki *et al.*, 1988, 1998; Mariş and Mariş, 2012), over four solar cycles (solar cycles 20–23, 1964 – 2008), list the basic parameters of such streams (duration, maximum speed, speed gradient). The last catalogue for solar cycle 23 (1996 – 2008) was set up in the frame of PN2 HELIOTER project (2007 – 2010). Further, we are setting up such catalogues for solar cycle 24. The first preliminary results for 2009 – 2012 are presented here. The fast stream dynamics during the analysed interval is compared with their dynamics of the first four years of the previous cycles.

NONLINEAR APPROACHES IN EXPERIMENTAL GEODYNAMICS

FLORIN MUNTEANU, DOREL ZUGRĂVESCU, CONSTANTIN UDRIŞTE

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The development of the processing techniques for nonlinear equations, the extraction of information from large heterogeneous databases (data mining), or the complex computational simulations generated, by the diffusion of some breakthroughs in physics and mathematics, a new approach named *Physical Complexity*. This new conceptual framework has reformulated many research fields including geophysics. It is defined as a new property: **geocomplexity**, the nonlinear behavior of geophysical processes and phenomena and the **geostasis**, the phenomenon of the dynamic balance between entropic processes (specific for non-living matter) and the entropy (specific in living realm). In this context, international scientific research stands in a reformulation of the experimental approach (new types of sensors (eco-sensors), new equipment, new strategies for the location of measurement points, etc.) or processing techniques. In this context, the paper summarizes some theoretical models and experiments conducted in the Department of UNESCO Chair in Geodynamics from the "Sabba S. Ştefănescu" Institute of Geodynamics of the Romanian Academy.

THE INDIRECT ASSESSMENT OF RIVER – TORRENTIAL EROSION BY DETERMINING THE VOLUME OF MATERIAL REMOVED FROM THE LEPŞA MORPHOHYDROGRAPHIC BASIN

LUCICA NICULAE

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A large scale research implies the study and quantification of the interdependence relationships between the hydrological processes and the rest of the physical-geographical factors in order to determine their influence on the quantity of water resources. The Lepşa morphohydrographic basin is a tributary of the Putna River and is situated in the North of the Vrancea Mountains, a tectonically highly active region. There are several methods for assessing river-torrential erosion indirectly by determining the eroded sedimentary deposits, such as: calculating the volume of material removed by torrential valley and ravines unbranched; calculating volume of material removed by river valleys with uniform cross sections; calculating volume of material removed by the difference between the initial volume and the present-day volume; erosion assessment based on the thickness of sedimentary deposit removed; summing negative volumes of contour lines.

FLUID CIRCULATION ALONG MICROFRACTURE SYSTEMS FROM SUBCARPATHIAN NAPPE DOMAIN DURING POST-COLLISION STAGE (11–0 MA)

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The continental collision between the East European and pre-Apulian plates triggered the uplift of the Subcarpathian nappe together with the other nappes belonging to External Moldavides. During post-collision stage, within the Subcarpathian nappe there has developed a wide system of microfractures which were filled with late calcite, quartz and gypsum. Elemental geochemistry and stable isotope of the calcite veins reveals that these microfractures were infilled with basinal brines derived from meteoric waters. The large temperatures of these fluids (105˚C to 237.1˚C) indicate their circulation at large depths in the thrust belt. In addition, both calcite and quartz or gypsum veins indicate that along these microfractures, hydrocarbons have migrated.

MAGNETIC STRUCTURES AS DERIVED FROM THE DIURNAL VARIATION OF THE GEOMAGNETIC FIELD RECORDED BY ASIAN OBSERVATORIES

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The geomagnetic field is varying at all scales, spatially and temporally. The primary external sources produce inside the Earth two types of responses, by two completely different phenomena, namely electromagnetic induction and magnetic induction. A magnetic induction model was used to determine both magnetic and electromagnetic induction components. Based on the magnetic induction component, the lateral variation of the magnetic properties of the crust was derived. Minute values of the geomagnetic elements X, Y, Z from 13 Asian geomagnetic observatories, during the time interval 1–31 May 2007, were used. The paper is part of a much larger project of the Natural Fields Department concerning the magnetic structure of the Earth's crust at a global scale.

EVOLUTION OF CARACI VOLCANO, SOUTH APUSENI MTS. GEODYNAMIC SIGNIFICANCE

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Caraci is an andesitic volcano located in the Metaliferi Mountains of the Southern Apuseni range, Romania. Its activity started with an explosive phreatomagmatic eruption that generated a tuff ring, followed by an effusive phase that breached the northern side of the initial structure. A second eruption starts with a south-eastward directed phreatomagmatic lateral blast followed by a major effusive phase that was dated at 11.33 Ma. The volcano records 2 more effusive eruptions, followed by the 10.51 Ma dome building eruption. This last eruption also generates multiple block and ash flows by sector collapse. Postvolcanic activity follows with hydrothermal fluid circulations and ore deposition. The volcano is emplaced inside a small-scale, north dipping wedge-like basin bounded by normal faults. AWNW-ESE normal fault system has developed transversally, as an adjustment response. The formation of this wedge-like basin implies rotation processes, and it opens towards the greater Zărand basin in the north. They show connection and are genetically linked to each other. The opening of the Zărand basin has induced stress in the neighboring areas, which have accommodated in a similar manner, by rotational movements. These rotations have induced extension, which had the potential of generating small sedimentary basins, adjacent to Zărand, just as the one filled by the studied volcano. The geochemical similarity between Caraci andesites and the igneous products erupted by neighboring volcanoes in the same time-frame suggests a similar source. We assume that the magmas erupted from Caraci were generated under the same circumstances, by lithosphere decompression melting induced by the opening of Zărand basin. The small-scale extensional basin filled by Caraci has provided a way of magma passage active for ~1.5 million years, via faults.

ANALYSIS OF GEOMAGNETIC SIGNAL ASSOCIATED WITH SEISMIC EVENTS

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This paper analyzes the correlation of geomagnetic signal in parallel with produced seismic events. For processing, five data sets were used: NS and EV horizontal components, vertical component, total horizontal (H) component and vertical/horizontal ratio. Earthquakes with magnitude over 3.5 on Richter scale in the period March – April 2009 were taken into consideration. It was noticed that in most of the frequencies of the recorded signal phase variation occurs randomly. However, at certain frequencies, phase and amplitude variations occur in a certain way, few days before a seismic event. The complex system of monitoring and processing in real and quasi-real time in the Proviţa de Sus area is designed to track the factors that appear before seismic events. A database that can be analyzed in parallel with seismic activity was realized. Thus, one can develop an effective method of forecasting the short-term seismic activity in the Vrancea seismogenic region. Mathematical processing of recorded geomagnetic data provides information about seismic events. The amplitude and phase variations of the geomagnetic signal were processed. A specific variation of the geomagnetic signal occurs in a period prior to the seismic event with magnitude greater than three on the Richter scale. This kind of variation is repeated before every similar seismic event. The time of the electromagnetic anomaly is 3–8 days before the earthquake. This method has been tested on more than 10 seismic events that occurred in Vrancea, in the period between 2005 and 2011. It is to mention that no geomagnetic storms were reported in the analyzed period.

REVISED SPACE–TIME EVOLUTION OF MONOGENETIC VOLCANISM IN PERŞANI MOUNTAINS

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The Perşani Mts. basaltic field is the most important in the East Carpathians (Romania). It consists of a complex volcanic field in the center and several monogenetic volcanoes, situated to the north and south along a ~NE–SW normal fault system. The volcanoes were built-up on a basement mostly represented by Mesozoic sedimentary formations and by Miocene rhyolitic volcaniclastic deposits. According to recent Ar/Ar dating and palaeomagnetic investigation, the volcanism took place in several episodes (pulses) occurring at 1162–1220, 1049–1059, 815–817, and 669–687 Ka (isochron ages), respectively, however not all of the volcanoes have been dated. The Ar/Ar dating, together with new volcanological field evidence allowed the identification of six (6) new volcanic edifices, thus providing a better picture of the eruptive sequences. All monogenetic volcanoes were rapidly constructed and with few exceptions, no matter of timing, their activity started with a phreatic/phreatomagmatic explosive phase. The hydromagmatic processes that resulted from the interaction of ascending magma with the shallow phreatic aquifer, sometimes associated with magmatic eruptions, characterize the inception of the volcanic activity. This phase was generally followed by a less energetic explosive one (Strombolian), generating cinder cones with agglutinated spatter deposits around the emission center and massive to bedded scoriae lapilli deposits, on the outer slopes. The morphometric variability of the scoria cones, in particular the decreasing of the flanks' slope angles was most probably caused by erosion and degradation, as the correlation between morphology and age suggests. At almost all locations the final phase was effusive, represented by lava flows that strongly disturbed the initial explosive-generated edifices. The main tectonic alignments directed on a NE–SW trend are crossed by NW–SE trending faults and clearly suggest the tectonic control of eruptions; most of the volcanoes were generated at the intersection of the two fault systems. The depression generated by the normal fault system along the NE–SW branch of Bogata valley allowed convergence of several lava flows generated by different volcanoes in different periods of time.

POSSIBLE CORRELATION BETWEEN THE PRE-SEISMIC ANOMALOUS BEHAVIOUR OF THE NORMALIZED FUNCTION Bzn AND THE INTERMEDIATE-DEPTH EARTHQUAKES – VRANCEA ZONE

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This paper is focused on a specific EM methodology able to emphasize the pre-seismic anomalous behaviour of the EM parameters related to the intermediate-depth earthquakes occurred in Vrancea zone. In seismogenic studies, the volatiles transport is one of basic features related to both the earthquake preparation and associated electromagnetic precursors. Taking into account the concept according to which the most of the rocks, composing crust and upper mantle, can emanate molecular hydrogen due to anhydrous minerals which must contain some water as impurity of OH^- in their crystalline structures, it is also reasonable to suggest that continuous geotectonic systems (deep faults) do exist and may represent ideal conducting channels. Thus, the pre-seismic changes of the electrical conductivity due to dehydration of the rocks and fluid migration through faulting systems, acting as high sensitive path, could be detected by means of the anomalous behavior of the Bzn(f) parameter, monitored in 2013, at the Geomagnetic Observatory Proviţa de Sus, in the frequency range 0.001Hz to 0.016Hz. Analyzing the correlation of the Bzn* distribution (obtained by using a standardized random variable equation) with the Vrancea's seismic events of Mw≥3.7, we may conclude that: (i) a pre-seismic anomalous interval of the function Bzn* may be a hint of impending earthquake; (ii) the anomalous intervals are pre- and co-seismic events and, when the stability and instability domains are very close, a superimposed effect is also reflected by maximum values. The lead time is between 1 to 32 days before the earthquakes occurrence.

M9 GREAT TOHOKU EARTHQUAKE AND ITS GLOBAL PRE-SEISMIC GEOMAGNETIC EFFECT

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It is supposed that prior to large earthquake its focus may send through the Earth crust transient signals, sometimes strong, but more often very weak and fleeting. Passing through the crust these signals may consist of magnetic field variations, seismo-electric signals (SES) and electromagnetic (EM) emissions, over a wide range of frequencies. Subsequently, in this paper, we retrospectively analyzed the geomagnetic data collected at three observatories placed in Japan (Memambetsu, Kakioka) and Romania (Proviţa de Sus), to confirm the global pre-seismic anomalous geomagnetic effect related to the M9 Great Tohoku earthquake on March 11, 2011.The daily mean distributions of the geomagnetic parameter Bzn = Bz/Bperp (where: Bz is the vertical component of the geomagnetic field; Bperp is the geomagnetic component perpendicular to the strike orientation) and its standard deviation (SD) are derived in the frequency range (0.001Hz to 0.016Hz) by the use of the FFT band-pass filter analysis. In pre-seismic conditions, the parameter Bzn has a significant enhancement due to the crustal resistivity changes, possibly associated with the earthquake-induced rupture-processes and fluid flow through the faulting system developed inside the focus and its neighboring volume. After analyzing the Bzn anomalous values obtained at Memambetsu, Kakioka and Proviţa de Sus observatories by using a standardized random variable equation, a pre-seismic peak greater than 2.5 SD related to the M9 Tohoku earthquake was identified on 5–6 February 2011. The lead time is 32 days before the M9 Tohoku earthquake occurrence. The final conclusion is that the detection area of pre-seismic effects, under favorable conditions, could be extended to considerable distances from the epicenter of large earthquake.

CHARACTERISTICS OF THE RADIAL COMPONENT OF THE GEOMAGNETIC FIELD AT CORE SURFACE

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The long-term changes of the main field, the so-called secular variation, are related to the processes occurring in the fluid outer core of the Earth. Therefore, the knowledge of the secular variation is important in understanding these processes. High-frequency ingredients, present in observatory data and main field models, are also components of the radial field evolution at core surface. The aim of the paper is to analyze the characteristics of the ~80-year variation of the radial component in *gufm1* main field model (Jackson *et al.*, 2000). Time-longitude and time-latitude plots covering a time span of about 320 years, at various latitudes/longitudes, constructed to better understand the movement of the features of the ~80-year variation on the surface of the core, showed a westward displacement in the equatorial region of the core surface of about 0.27 deg/yr. The presence of a northward component of the movement of higher latitude features is also indicated. The first time derivative of the ~80-year variation of the radial component is analyzed too. It indicates similar displacements of secular variation foci.

GEODYNAMIC MONITORING OF PECENEAGA–CAMENA FAULT. BASPUNAR OBSERVATORY

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The Başpunar Geodynamic Observatory has been set up within the Solid Earth Dynamics Laboratory of the Institute of Geodynamics in order to highlight and monitor possible motions on Peceneaga–Camena Fault and eventually to correlate variations in slip rates with seismicity in Vrancea and neighboring areas. Because recordings are strongly affected by changes of atmospheric parameters, sustained efforts have been made in order to improve the technical conditions and to correct the observations affected mainly by temperature, pressure and air humidity changes.