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RECENT ADVANCES in GEOLOGY and SEISMOLOGY

Cambridge, UK, February 24-26, 2009

Proceedings of the 3rd IASME / WSEAS International Conference on
GEOLOGY and SEISMOLOGY (GES'09)



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Preface

This year the 3rd IASME / WSEAS International Conference on GEOLOGY and SEISMOLOGY (GES'09) was held in the University of Cambridge as in 2008. The Conference remains faithful to its original idea of providing a platform to discuss theoretical and applicative aspects of mineralogy, petrology, climatology, geophysics, dynamic tectonics, earthquake engineering etc. with participants from all over the world, both from academia and from industry.

Its success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

During this last year we witnessed the growth of the European Union interest in Geology and Seismology. This is an additional proof that they are seen not only as an exciting research area but also as technologies that may solve current European citizens' concerns with several practical problems.

For a discipline which is central to research and also to industry, and which generates interests not only among academicians but also among large companies and government departments and agencies, it is important to look at the market and at its movements.

A Conference such as this can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors

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Plenary Lecture 1

Is there a Relation between the Geological Structure and the Prehistoric Art Manifestations? A Case History: The El Castillo Mountain Prehistoric Caves, Puente Viesgo, Cantabria, Spain



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Abstract: The relation between the regional geological structure, characterized by the presence of major Hercynian thrust and normal faults with a second sequence of minor alpine faults, and the evolution of the karstic phenomena and consequently the development of the caves in the El Castillo Mountain, they have been demonstrated many years ago.

Recently, during the geological risk and stability research works, taken into account inside the five caves with important representations of prehistoric parietal pictures, a special, perhaps strange relation between the little fracture joints and the situation of the pictures, have been detected.

Here we show the geological observations carried out inside the caves, the geological cartography of the discontinuities, and a collection of the main art manifestations in the El Castillo Mountain Prehistoric Caves.

Brief Biography of the Speaker: Was born on 1949 in Lugo, Galicia, North of Spain. Graduate in Geology (1976) and Doctorate in Geology (1980) in the University of Oviedo, Asturias.

Since 1977, as a Chief of the Applied Geology Research Group of the University of Cantabria, participate in many civil engineering projects, mainly in motorways, large dams foundations, geological risk in hydraulic works and since 1999, in the geological risk research around the main prehistoric caves in the North of Spain.

Since 1977, Professor of Applied Geology to Public Works, since 1983, Professor of Geomorphology and Engineering Geology in the Civil Engineering School of the University of Cantabria, and between 1993-2004 Prof. of Dam Geology in the Master of Engineering Geology, Geological Faculty of the University of Madrid. Member of the Cantabria International Institute for Prehistoric Research.

Director of many Projects I+D+I and Postdoctoral Courses in relation with the University of Paderborn and Universität Münster, Germany, San Luis Potosí University Technological Institute of Monterrey, Mexico, Université Bordeaux I, France, Polytechnic Institute J. A. Echevarría, Cuba, Salamanca University, Spain, and the UNED Costa Rica.

Actually, Director of the Ground Engineering and Material Sciences Department of the Cantabria University, Spain.

Plenary Lecture 2

Geosystemics



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Abstract: For geosystemics we define the science that studies the Earth system from a holistic point of view. Earth is thus considered as a whole and unique far-from-the equilibrium complex system. Although it is formed by numerous different parts (sub-systems), these parts do not act independently but interact each other continuously. Most interactions are nonlinear, so that we can usually say that “resultant is more than the sum of the parts”. Interactions are not only in terms of contrasts but, and mostly, cooperations and mutual organizations. We will see some aspects and properties of this phenomenon with some examples.

Brief Biography of the Speaker: I have been working since 1977 in the National Institute of Geophysics and Vulcanology of Italy (INGV). I took my Doctor Degree in Physics (1984) at University of Rome (Italy). My main interests are in: a) Models in Earth sciences, with particular attention to geomagnetism; b) Search for nonlinearities in Geophysics; c) Geomagnetic Deep Sounding; d) Potential Field Theory; e) Magnetometry and Riometry. My present position at INGV is as Director of Research (since 1999). I have been Head of Geomagnetism Group for 5 years (from 2000 to 2005). I received a Royal Society 5-month Grant visiting the British Geological Survey (1987). Former Member of INGV Scientific Committee 1999-2005 and former Member of ESA Swarm satellite Mission Advisory Group Phase A. I am presently formal member of INGV and INFN (National Institute of Nuclear Physics of Italy) Committee. Professor of Solid Earth Physics and then Geophysics at Chieti University (from 1998 to present). I have been member of 5 Italian expeditions in Antarctica and I coordinated all scientific activities during the XI Antarctic expedition. I have been responsible of many National and International Projects: Riometry, ARM I, II, REM within the “ItaliAntartide” Program, 1993-2006; bilateral Cooperation Italy-Spain 1994-1996; bilateral Cooperations: Italy-Czech Rep. 1996-1999, Italy-Albania 2002-2004, 2007-present; NATO 1999-2001. Vice-Responsible of Space Weather Project within the “ItaliAntartide” Program, 1996-1999. I coordinate some programmes of research in the framework of Oersted and Champ satellite missions 2001- present. I cooperate with many Italian Universities following graduates and PhD for theses. I also teach some PhD Courses in Geophysics (2000- present). I count around 140 scientific publications (70% are International) and 150 scientific communications at national and international conferences.

Plenary Lecture 3

Epileptic Seizures: Quakes of the Brain?



Professor Ivan Osorio

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Abstract: Earthquakes, hurricanes, landslides, financial crashes, and epileptic seizures are catastrophic events thought to exhibit similar self-organized behavior found in complex systems. The proposed analogy is based on statistical similarities, such as a power law distribution of event sizes, and on common structures in terms of coupled threshold oscillators of relaxation. But, beyond the analogies, what can we learn from them and how can this knowledge be used to advance each relevant discipline? Here we demonstrate a striking correspondence between seizures (SZ) and Southern California earthquakes (EQ), extending over seven statistics which exhibit remarkably robust scale-free properties: The Gutenberg-Richter distribution of event sizes, the Omori law, the inverse Omori law of foreshock rates, and the conditional distribution of inter-event times, among others. Then, based on a theoretical framework developed for EQ and using an animal model of epilepsy, we verify the prediction that increased neuronal coupling leads to synchronized SZ behavior with characteristic SZ size and time scale. Translating back from SZ to EQ, the proposed analogy, informed by the rats' results, suggest that characteristic EQ behavior, proposed based on controversial observations, should be a genuine class of dynamics in relevant seismotectonic settings characterized by strong coupling and low crust heterogeneity. Taken in their totality, the SZ-EQ equivalencies explain the wide range of SZ energies, the existence of metastable epileptic states (from SOC to quasiperiodicity), memory, and their inherent self-triggering capacity. They also point to a general strategy for forecasting SZ capitalizing on the mechanism that future events are in part triggered by past events. While this mechanism is the basis of time-dependent EQ forecasts, the implications for SZ remain to be exploited. This approach may bring us closer to one of neurosciences' grails: prediction and prevention of SZ.

Brief Biography of the Speaker: Ivan Osorio is a Professor of Neurology at the UNiversity of Kansas Medical Center and Visiting Scientist at the Dept. of Mathematics, Haverly Mudd College, Claremont, Ca. He is a graduate of the Universidad del Valle School of Medicine. He applies mathematical tools and a systems approach to the study of epilepsy, a dynamical disease, with cyclic but aperiodic manifestations. The group which he leads demonstrated the feasibility and safety of seizure control using high frequency electrical currents, triggered by the automated real-time detection of non-stationary signals changes. His collaboration with Professor D. Sornette from ETHZ has led to the uncovering of dynamical similarities between epileptic seizures in human and animals and earthquakes.

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