Interdisciplinary cooperation and studies in geoscience in the Carpathian Basin

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An interdisciplinary approach to geoscience is particularly important in this vast research field, as the more innovative studies are increasingly crossing discipline boundaries and thus benefitting from multiple research methods and viewpoints. Grasping this concept has led us to encourage interdisciplinary cooperation by supporting and promoting the creation of “meeting places” able to provide a framework for researchers and scholars involved in geoscience research to find common grounds for discussion and collaboration.

Most recently, this was achieved by organizing the 1st Workshop on “Interdisciplinarity in Geosciences in the Carpathian Basin” (IGCB) held in the Department of Geography at the University of Suceava (Romania), between the 18th and 22nd October 2012. This event brought together both an international group of scientists and local researchers which created opportunities for collaboration in research topics such as geography, environment, geology and botany, biology and ecology in the Carpathian Basin.

In terms of the area on which this workshop was focused, i.e. the Carpathian Basin, to date this is one of the least studied and promoted areas in Europe, despite its significant scientific potential and relevance to the European space. Moreover, this is perhaps also the case with regard to Romanian research which needs to be brought up to date in terms of scientific approach, concepts and methodology.

The main goal of this workshop was to facilitate contact with the latest developments in geosciences in the Carpathian region by providing an opportunity for experienced researchers and academics from Europe (e.g. UK, Poland, Slovakia, Hungary, Czech Republic, Austria, Serbia, Ukraine and Romania), who have shown a particular interest in this area of study, and younger researchers, students and doctoral students to meet and explore future collaborations.

The proceedings of the workshop included presentations of various research projects set in the Carpathian Basin and pertained to various fields, such as geography (geomorphology, hydrology, GIS, biogeography), biology (botany, ecology, palynology), geology (speology, cave records, quaternary science), environmental science (human impact, limnology/palaeolimnology, palaeoenvironment) and tourism.

Considering the wide scope of the contributions presented by the 41 participants based in 7 countries and the fact that several collaborations have been established following the event, this

event provides a good example of how to successfully promote interdisciplinarity and cooperation. It must be noted that this workshop came as a natural continuation of a previous activity which brought together researchers from across Europe within the 1st Workshop on Regional Climate Dynamics "Climate change in the Carpathian-Balkan region", held in the same venue in Suceava, Romania, in June 2011 (see Vereș and Mîndrescu, in press).

Overall, we believe these kinds of events are highly beneficial for researchers and academics providing contact with new methods of analysis, ideas, and approaches, which may further contribute to an increase in the quality of Romanian geoscience research. Furthermore, they can bring us a step closer to effectively creating a network of scientists from various fields and levels of expertise who are interested in this region. We envisage that this workshop (IGCB) could be continued in future years and as such we are already establishing a Working group on Interdisciplinarity in Geoscience in the Carpathian Basin (WGIGCB) comprising of the participants in the workshop, as an opportunity for further networking and collaboration.

This event also included the Honoris Causa Degree ceremony for Reader Emeritus Dr. Ian S. Evans of Durham University (UK) awarded by the University of Suceava as recognition of his merits in promoting its Department of Geography and Romanian geographical research in general, for making a significant contribution to the development of Romanian geomorphology by collaborating with academics from several universities (e.g. Suceava, Timişoara, Iaşi, Bucureşti) during the past four decades, as well as for his achievements in international scientific research. The two main topics Dr. Ian Evans has made his own throughout his career, and are recognized as such, are glacial and general geomorphometry.

Dr. Evans first visited Romania in 1974, camping in the mountains and visiting researchers Ioniţa Ichim and Maria Rădoane at the Research Station, Pîngăraţi, Piatra Neamţ. During the past 15 years, Dr. Evans has hosted a number of Romanian visitors to Durham, after establishing with Prof. Maria Rădoane an Erasmus link between Durham and the University of Ştefan cel Mare in Suceava in 1999. The first student to study in Durham was Marcel Mîndrescu, with whom he started a collaboration resulting in both conference presentations and joint papers. Their earliest joint paper discussed the distribution of former glacier sources in the Romanian Carpathians (Mîndrescu e*t al.,* 2010a). The latest analyzed the form of all 631 cirques in Romania and their relation to various factors such as geology, altitude and position (Mîndrescu and Evans, in press).

A further example of British-Romanian collaboration focused on the Carpathian region was initiated in 2006 between the authors of this paper. To date our investigations of recent lake sediment deposits (which now also include the Senckenberg Research Institute and Natural History Museum, Frankfurt (Germany) through Dr. Angelica Feurdean) have covered a range of depositional environments across the Carpathian Basin, but have tended to focus on the more recent past and primarily the post Industrial Revolution period. Hutchinson and Mîndrescu (2012) summarise the range of their lake-sediment based collaboration which also exemplifies an interdisciplinary approach to environmental science which is particularly important in the field of palaeoenvironmental research. The investigation of depositional environments as archives of environmental history has a long tradition in the Carpathian region. However, glacial lakes across the region have also been described as under-investigated despite their potential for palaeolimnological study (Buczkó *et al.,* 2009). Studies have also largely focused on relatively early (Late Glacial and Early Holocene) environmental change. Nevertheless, there is an increasing interest in the reconstruction of more human-driven impacts on the environment and events in the very recent past on a century to decade timescale e.g., post Industrial Revolution and following political change from the mid 1940s and in the late 1980s. Furthermore, efforts

have are also being made to inform the debate about future climate and environmental changes linking palaeoenvironmental records to predictive modelling.
The papers included in this volume (originating from contributions during the IGCB workshop proceedings) integrate a wide range of topics related to Carpathian basin area. These contributions reflect current environmental changes studies mostly connected with river corridors (the morphology and morphodynamics of river bed and its impact of biodiversity, the hydromorphological quality of the Polish Carpathian rivers, reservoir impacts on sediments and biodiversity, hydrological models applied on small rivers,) and others (landscape management, soil quality assessment, international cooperation on occurrence of toponyms in limnology, karst records analysis in Ukraine, Holocene vegetation history in the Eastern Romanian Carpathians, glacial cirques geomorphometry in the Slovak High Tatra, glacial and periglacial geomorphosites in the Trannsilvanian Alps).

The paper opening this volume (Radecki-Pawlik and Lsiażek, in this volume) presents a detailed investigation of the morphology and morphodynamics of sand and fine-gravel subaquatic dunes on the Raba River, Vistula basin, Poland. The dunes formed on the Raba River bed estuary are composed of sand and fine gravel (d_{50} up to 11 mm). Systematic observations (2000-2005) were made on the geometry, sediment composition and hydraulic climate under which the dunes grew and decomposed. The investigation focuses mostly on the geometrical parameters of these bed forms such as height, length, as well as granulometric characteristics of the sediment. Based on in-site measurements different hydraulic parameters were calculated such as shear stresses, resistant coefficient, Froude and Reynolds numbers and roughness coefficient. The importance of the hydraulic parameters upon river ecology and floodplain environment was mentioned.

The second paper (Izakovičová and Oszlányi, this volume) presents an evaluation of the Ipel river basin (tributary of Danube, Slovakia), examining its sustainable development. They devised a methodology for integrated landscape management as a basic tool for the implementation of sustainable development. The main objective of this case study is to define the socio-economic and environmental problems, to design measures to eliminate these problems and/or to prevent new problems arising. The ultimate goal is to achieve management practices which are in harmony with this area's potential, to the greatest possible extent. Thus, basic principles are applied to landscape-ecological optimization of landscape organisation, including nature protection, biodiversity, landscape stability and the protection of its natural resources. These involve its water and soil and the air/atmosphere in its forests. The protection of its cultural-historical resources is extremely important, including, inter alia, the protection of cultural monuments, protection of historical landscape structures and protection of the entire environment.

Patriche *et al.* (in this volume) from "Alexandru Ioan Cuza" University of Iaşi and the Romanian Academy, Iași branch, Romania, summarise several statistical tools, namely regression trees, logistic regressions and fuzzy techniques, for the spatial prediction of soil qualitative variables in the Dobrovăţ basin, Moldavian plateau, Romania. Compared to a classical approach in soil survey, a statistical approach has the advantage of taking into account and rendering the spatial continuity of soil cover and its properties, allowing the estimation of soil parameters, with a degree of accuracy, both inside (interpolation) and outside (extrapolation) the area of interest. The results show that all methods were able to successfully predict the occurrence of Aluviosols, Chernozems and Luvisols, while the rate of success was lower for the other soil types.

Important relationships between the biotic characteristics of Polish Carpathian rivers, and the variation of physical habitat conditions and hydromorphological quality of the rivers were

highlighted by Wyżga and Zawiejska (in this volume). These indicated that recovery of the degraded communities will require restoration measures increasing the morphological complexity of the watercourses. Environmental changes that took place in Carpathian catchments during the twentieth century have changed water and sediment fluxes in the rivers and thus invalidate the historical state of the watercourses as reference for their restoration. An erodible corridor seems to be a restoration measure enabling the most effective adjustment of a degraded river to its contemporary regime as well as re-establishment of geomorphic dynamic equilibrium conditions and improvement of hydromorphological conditions for river biota.

An excellent example of international cooperation in the Carpathian Basin is provided by Grădinaru *et al.* (this volume). The paper investigated the distribution and evolution of toponyms derivative of the words „iezer" and "bolătău" (Romanian) and their counterparts in the neighboring countries, where such homologous words/toponyms exist, i.e. Poland, the Czech Republic and Slovenia. The authors documented that toponyms based on both words are still in use in a large number of derivative variants (especially in the Slavic-speaking countries), which attest their age and relevance in the toponymical practice, albeit to a different extent and with national and regional variations in terms of occurrence. Also, in was observed that currently the vast majority of toponyms based on the two terms do not refer to water bodies at all, but have been transferred to other elements of the landscape, such that they cannot be relied on as predictors for geomorphological features such as lakes, reservoirs and ponds.

Although caves in the Ukrainian Carpathians are not numerous due to the limited extent of karst rocks, Ridush (in this volume), analysed clastic cave deposits from eight caves (Druzhba, Caves of Viv Cliff, Perlyna „Pearl", White Walls, Bear Fang, Chur, Karst Bridge, Molochnyi Kamin' "Milk Stone") located in the Western Ukrainian caves. The palaeontological records with palaeoenvironment importance are represented mainly by Vertebrate faunal remains: *Ursus spelaeus, U. arctos, Panhera leo* cf. *spelaea, Martes martes*, *Meles meles*, *Vulpes vulpes*, *Felis silvestris*, *Rangifer tarandus*, *Bison priscus, Ochotona* sp. Due to their uniqueness in the region of the Eastern Carpathians, the caves of the Uholka massif are valuable archives of the paleogeographic information. Their paleogeographic, paleontological and archaeological potential is not entirely known.

Panait and Tanţău (in this volume) present pollen analysis from two peat bogs from the Harghita Mountains, Romania. The vegetation record, which is supported by five ^{14}C dates, starts in the Subboreal with the *Carpinus* optimum. During the Subatlantic the vegetation is dominated by *Fagus*. Indications of human activities in the region occur at the beginning of the Subboreal. Significantly, in terms of the history vegetation of this mountain range during the Late Holocene the vegetation of Harghita Mountains was mainly dominated by *Carpinus* forests between 4500 and 3000 years BP and by *Fagus* forests between 3000 BP and 200 years BP. This shift of vegetation could be an important threshold in climate evolution of the region and this hypothesis has been supported by other such studies in the Eastern Carpathians.

The main purpose of the paper of Kupková and Mentlík (in this volume) from University of West Bohemia, Plzeň, Czech Republic, was to investigate basic morphometric characteristics of glacial landforms in the High Tatras, Slovakia. Former glacier size (during the LGM) was reconstructed through the morphometric characteristics (e.g. width, length, average altitude, azimuth) which were measured in GIS on the basis of the geomorphological map of Lukniš (1973). The research suggested that the area's glacial landforms were formed during different conditions. Whereas the northern side of the range was more affected by their west-east aspect, the southern side of the range was affected by the altitude and geological uplifting. Geomorphometry of glacial

landforms of the Tatras can be extended and compared to simliar studies elsewhere in Europe such as the Romanian Carpathians (Mindrescu et al., 2010a).

A brief analysis documenting how reservoirs influence the sediment discharge of the rivers by sedimentation is presented by Obreja (in this volume) from „Stefan cel Mare“ University of Suceava, Geography Department and „Siret“ Water Administration, Bacău, Romania. He used Trap efficiency (TE) as an indicator of sediment yield from upstream basin and for sedimentation rate within reservoirs. Therefore, this parameter was calculated for 14 reservoirs in the Siret Basin (Eastern Romania), one of the most developed river basins in Romania in terms of reservoirs. This paper is meant to be a starting point for further analysis on the TE and the reservoir silting which should result in a prediction model for sediment yield in the Siret Basin.

Collaborators from the University of Suceava, Romania and the Brandenburg University of Technology, Cottbus, Germany presented a study case of Baranca (Siret basin, Romania) drainage basin flash-floods using the hydrological model of Hec-Ras. The simulation of the 2010 flash-floods that occured in the Baranca drainage basin was used to provide a realistic picture of informational programs that can be used for flood management. The programs used, taking an acceptable margin of error, may be integrated into any flood management strategy or in any watershed plan and may provide the necessary support for mitigating the risks associated with floods (Haliuc and Frantiuc, in this volume).

Lastly, by using a methodology developped by Pralong (2005) and Reynard *et al.* (2007), Murătoreanu *et. al.* (in this volume) identified a range of geomorphosites with glacial and periglacial origins which have scientific, economic and touristic value in the upper basin of Ialomiţa River, Bucegi Massif, Romania. Applying evaluation criteria has allowed the allocation of values to these geomorphosites in the area under analysis, which subsequently could be used more widely and could be compared to others in the Romanian Carpathians.

The workshop on Interdisciplinarity in Geoscience in the Carpathian Basin (IGCB) has been a successful attempt to further the process of sharing the latest scientific gains in the study of this region, and in providing synergies for transboundary collaborationwhich may be through the framework of a future initiativesuch as the Carpathian Basin Working Group. After the closing session of the workshop, a discussion ensued regarding the usefulness of such meetings reuniting researchers from various fields of study and experience who are focused on a study area such as the Carpathian Basin to the benefit of research in this region. It was agreed that such a workshop should be organized every two years, based on the activity of the Working group on Interdisciplinarity in Geoscience in the Carpathian Basin (WGIGCB) which included all the participants in the workshop, as well as other scientists who work in this region and can bring scientific know-how to this network of researchers.

Considering the high quality and the number of valuable scientific contributions presented in the workshop, we were able to edit two volumes (21 and 22) of Georeview. Scientific Annals of "Ştefan cel Mare" University; Geography series (www.georeview.ro), which present papers submitted by the participants.

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