Summer School on Carpathian-Danube Delta-Black Sea sedimentary system

Networking and Dissemination Activity within a EUROCORES Programme

Danube Delta, Romania, 25 September – 1 October 2009

EUROCORES Programme
European Collaborative Research

EUROPEAN SCIENCE FOUNDATION

SUMMARY

The major earth surface units, -mountains, plains, and marine basins- are linked into a source to sink sedimentary system. The source-areas (mountains) erosion generates detrital material supplied to and transported by river systems to the plains, and accumulated and stored in the sink zones (sedimentary basins). Deltas play the important role of gateways between the sediment transporter and the final sediment accumulation in the sink area.

One of the most important European source to sink organisms is the Carpathians – Danube River – Danube Delta – Black Sea sedimentary system, which operated in the past and is still active to day. The Danube River Basin – Black Sea area represents a unique natural laboratory for studying the interplay between lithospheric and surface processes and the source-sink relationships.

The Carpathians to Black Sea past and modern erosion, transport and accumulation sedimentary processes will be linked by an integrated modeling approach. In this way reliable links will be established between lithosphere dynamics, neotectonics, surface and climatic processes. The models should cover different scales and aspects of the Carpathians – Black Sea source-sink sedimentary balance. Understanding the entire system balance will equip large-scale modelers for the first time with tools to analyze the higher resolution system components.

The drainage network of the Danube River system and its transition zone to the active sink area of the Black Sea responds rapidly to changes in the upper reaches of the source-sink system. As active processes provide the key link to the sedimentary balance of this system, these are influenced by the inherited memory from the Carpathian collision time, rapid sea-level changes, basin filling patterns and climatic instability.

The SourceSink Project analyzes the interplay between tectonics, sea level fluctuations, sediment supply and connectivity with the upstream Paratethys basins during the recent evolution of the Black Sea, as reflected in the 3D architecture of the Upper Miocene-Quaternary sediments. An important objective of the project is to establish when, where and how was the Western Black Sea connected to these Paratethyans basins, in particular the Carpathians foredeep (Dacian Basin) leading to major shifts in sediment supply and patterns of basin fill.

The Danube Delta was, and still is the sedimentary gateway at the interface between the Dacian Basin (in the past) or the lower Danube River (in the present) and the Black Sea. The SourceSink investigations aims to a comparative analysis between the deltaic filling patterns observed during the Pliocene in the Carpathian foreland and the modern sedimentological processes (Upper Holocene towards the last 30 years).

The proposed summer school focussed on the past and recent sedimentary architecture and processes in the Carpathians-Black Sea system. A special attention was granted to the sedimentary gateways between segments of the source to sink system. Modelling of the sedimentary architecture generated by sediment redistribution from the source to the sink is also an important objective of the proposed summer school. The summer school program includes field applications in Danube Delta and the Dacian Basin area.

DESCRIPTION OF SCIENTIFIC CONTENT AND DISCUSSION AT THE EVENT

The topography of the continents and their margins is at the interface of deep Earth, surface and atmospheric processes. Topography influences society, not only as a result of slow landscape changes but also in terms of how it impacts on geohazards and the environment. When the sea levels, as well as the lake-level and that of ground-water one rise or land subsides, the risk of flooding increases, directly affecting the sustainability of local ecosystems and human habitats.

On the other hand, declining water levels and uplifting land may lead to higher risks of erosion and desertification. Although natural processes and human activities create geohazards and environmental changes, the relative contribution of the respective components remains poorly understood. That topography influences climate has been known since the beginning of civilization, but only recently we have been able to model its effects in regions where good (paleo-)topographic and climatologic data are available.

The present state and behaviour of the shallow Earth System is a consequence of processes operating over a wide range of temporal and spatial scales. These include the long-term effects of tectonic uplift, subsidence, climate variations and the development of river systems, the residual effects of the ice ages on crustal movement, natural climate and environmental changes over the past millennia up to the present, and the powerful anthropogenic impacts of the last century. The challenge to the Geosciences is to describe the state of the system, to monitor its changes, to forecast its evolution and, in collaboration with others, to evaluate modes of its sustainable use by human society.

One of the goals of the project is the study of the geomorphological and geo-environmental evolution of the interface between the river network and the active sink, having as the case study the Danube. The goal of the project is to investigate the factors which governed the geomorphologic and geo-environmental evolution during the last 5Ma of the Lower Danube –Danube Delta – Black Sea carrier system. The project is focussed on the lower Danube River and on the sedimentary gateway at the interface between the Dacic Basin and the Black Sea, i.e. the modern Danube Delta. The study aims a comparative analysis between the deltaic filling patterns observed during the Pliocene in the SE Carpathians foreland and the modern sedimentological processes (Upper Holocene towards the last 30 years) observed in the Danube and Danube Delta at the interface with the Black Sea. This general objective will be obtained by the means of data acquisition, interpretation and modeling focused around 5 topics.

During the morning of the 26th of September, Prof. Dr. Nicolae Panin (Geoecomar) presented a lecture concerning the Danube Delta – the mid term of the geo-system Danube

River – Danube Delta – Black Sea. Prof. Dr. Panin discussed about the Danube Delta, regarded as a highstand depocentre during Quaternary times. Also, the key lecture focussed on sediment volumes mobilised within the highstand depocentre aswell during within the lowstand depocentres, and also on the development of the Danube Delta closely dependent of the evolution of the Black Sea basin. Prof. Panin also presented data concerning the general morphology of the Danube Delta, Black Sea shelf and continental margin, Holocene evolution and facies types of the Danube Delta, and paleoenvironmental results of the analysis of the Danube-Danube Delta-Black Sea macrogeosystem.

The same morning on the 26th of September was dedicated to the presentation of Dr. Cornel Olariu (Austin, Texas, USA), which focused on modern and ancient deltas: formation, recognition and evolution. Several evolution models and sedimentological features of the paleodeltas and of actual deltas from different world regions were presented to the participants. Dr. Olariu also presented the analysis regarding the distributary channels of fluvial-dominated delta systems, the survey of delta front sediment accumulations using ground-penetrating radar, and genesis and significance of deltaic individual hyperpycnal-flow beds.

During the afternoon of the 26th of September, Dr. Gilles Lericolais (IFREMER-Brest, France) presented a lecture dedicated to Source to Sink: A Sedimentary Answer. Dr. Lericolais presentation was focused on the sedimentary evolution of the Black Sea, sea level fluctuations recorded in the Black Sea, as well as Black Sea depositional environments since the Last Glacial Maximum. Interesting new data and concepts were presented about the Messinian Salinity Crisis in the Eastern Paratethys Realm, including evidences of the presence of the Messinian erosion surface in the Black Sea.

The above-mentioned presentation was followed by the lecture of Prof. Dr. Cornel Dinu, who presented the Neogene and Quaternary tectonic evolution of the western Black Sea Basin. The structure and evolution pattern of the NW continental margin of the Black Sea, by integrating also fieldwork data and tectonic modeling of the Romanian Carpathians and adjacent areas, were also subjects of Prof. Dinu talk.

During the morning of the 27th of September, Dr. Daniel Garcia-Castellanos (Institut De Ciencies De La Terra Jaume Almera, (Barcelona, Spain), presented the record of the interaction between erosion/sedimentation at the Earth's surface and the tectonic deformation of the lithosphere. Using computer simulation techniques, Dr. Garcia-Castellanos focused on the interplay between lithospheric-scale tectonics and erosion/sedimentation at the Earth's surface.

During the afternoon of the 27th of September, Prof. Dr. Michal Kováč (Comenius University, Bratislava, Faculty of Earth Sciences) introduced the participants in the geological problems related to sequence stratigraphy and depositional systems of the Neogene deposits of the Central Paratethys Realm. The structural analysis and evolutionary tectonic model of the Alpine-Carpathian Belt was another subject of Prof. Kováč talk. In the same afternoon of the 27th of September, Dr. Juraj Francu (Czech Geological Survey, Brno Branch) presented to the participants multidimensional computer modeling of thermal history of the Alpine-Carpathian system, geochemistry of organic matter in rocks and petroleum, as well as clay minerals and organic matter in respect to thermal history and basin analysis.

During the one-day (the 28th of September) field trip in the Danube Delta (Fig. 1), the participants travelled by boat on the St. George branch (Fig. 2). This field trip was focused on observations of the present-day meanders, actual and old beaches, sediment input and sedimentary budget and sediment discharges of the St. George branch. Another goal of this field trip was to reach the Caraorman village, which the inhabitants of the dry land is attested from the Greek and Roman colonisation of the Black Sea coast. There, the main old beaches set on the Caraorman Formation. Barchan type dunes, up to 7-8 m high, occur, this location being a "*locus typicus*" to study littoral sands.

Fig.1 – Summer School field-trip in the Danube Delta

Fig.2 – Transport of the participants by boat on the St. George branch.

The SourceSink Summer School organized in Romania ended with a geological trip in the Eastern Carpathians (Fig. 3). This trip intended to present features of the Late Neogene deposits representing the sedimentary fill of the Dacian Basin, within the source-to-sink

context. The trip participants have been able to get knowledge on the structural geology and stratigraphy of the Carpathians Foredeep area (Fig. 2). Facial and lithologic characteristics of the deposits have been pointed out, as well as sedimentary features significant for the reconstruction of the sedimentary environments. A special attention was paid to the events that influenced the sedimentary influx and accumulation in the Dacian Basin during Neogene times. The itinerary of the trip went through a hilly area from the southern part of the Eastern Carpathians. The trip participants travelled several km along the Slănic River, a tributary of the Buzău River, between Lopătari and Sârbeşti localities. From the sedimentary and genetic points of view, the trip area was located at the transition between the eastern and the central-western Dacian Basin major facies (Fig. 3).

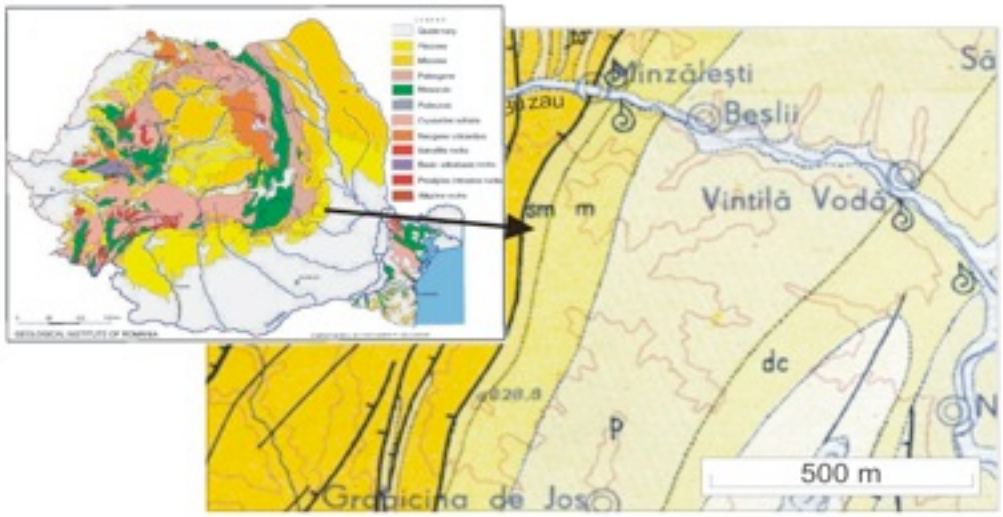

Fig. 3 – Geological field-trip area investigated in the Eastern Carpathians.

Fig. 4 – Participants at the Summer School investigating Upper Neogene-Lower Pliocene deposits in the Eastern Carpathians.

The eastern major sedimentary facies is characterized by a relatively large influx of sediments, coming from the most active and longer-lived source-area located in the southern

part of the Eastern Carpathians. The central and western areas of the Dacian Basin developed under the influence of a significantly lower amount of detrital material, coming from the Southern Carpathian source-area. The geological trip in the Dacian Basin extended over two successive half-days, after the arrival of the participants from the Danube Delta and before their departure to Bucharest. The day of the 29th of September was devoted to the observation of structural geology features in the Miocene Carpathian foredeep, as well as to the stratigraphic and sedimentogenetic examination of the Late Sarmatian (s.l.) and Meotian sedimentary successions. During the second day of field trip in the Romanian Carpathians (the 30th of September), the participants inspected the characters of the Miocene-Pliocene boundary interval (= Pontian regional stage) sediments (Fig. 4). A special attention was granted to the Eastern Paratethyan deposits from the stratigraphic interval corresponding to the time of the Messinian Salinity Crisis.

SUMMER SCHOOL PROGRAMME

Networking Activity on'Carpathian-Danube Delta-Black Sea Sedimentary System' within the framework of the ESF activity entitled 'Funding initiative in the field of 4-D Topography Evolution in Europe: Uplift, Subsidence and Sea Level Change'

24th-25th of September 2009 – Arrival of participants;

25th of September, 15.00 p.m. – departure to Murighiol (Danube Delta) from Geoecomar location (Dimitrie Onciul Street, No. 23-25, Bucharest);

26th of September: key lectures

- 9.00 to 11.00: **Prof. Dr. Nicolae Panin** (Bucharest, Romania): "The Danube Delta – the mid term of the geo-system Danube River – Danube Delta – Black Sea"
- 11.00 a.m – 11.15 Coffee break
- 11.15 to 13.00 – **Dr. Cornel Olariu** (Austin, TX, USA): "Modern and ancient deltas: formation, recognition and evolution"
- 13.00-13.30 *Discussion*
- 13.00 -15.00 Lunch
- 15.00 - 17.00 **Dr. Gilles Lericolais** (Brest, France): "From Source to Sink: A Sedimentary Answer"
- 17.00 -19.00 **Prof. Dr. Cornel Dinu** (Bucharest, Romania): "Neogene and Quaternary tectonic evolution of the western Black Sea Basin"
- 19.00-19.30 *Discussion*

- 20.00 - Dinner

27th of September: key lectures

- 9.00 to 13.00: **Dr. Daniel Garcia-Castellanos** (Barcelona, Spain): "Numerical modeling of long-term landscape evolution and connectivity between basins"
- 11.00 a.m – 11.15 Coffee break
- 13.00-13.30 *Discussion*
- 13.00 -15.00 Lunch
- 15.00 - 17.00 **Dr. Juraj Francu** (Brno, Czech Republic): "Modeling of basin subsidence and uplift history: Calibration of thermal history models"
- 17.00 -19.00 **Prof. Dr. Michal Kovacs** (Bratislava, Slovakia): "Subsidence History and Tectonic Control During the Development of the Western Carpathian Neogene Basins"
- 19.00-19.30 *Discussion*
- 20.00 Dinner

28th of September 2009 – Field trip in the Danube Delta (Murighiol-Lacul Puiu-Caraorman-Murighiol);

29th of September 2009

9.00 a.m. Departure from Murighiol to the bend area of the Romanian Carpathians (Buzau basin);

13.00-14.00 Lunch at Pleşcoi;

14.00 – 18.00 Field trip in the Neogene deposits of the Dacic Basin;

19.00 Dinner and overnight at Berca.

30th of September

9.00 Field trip in the Neogene deposits of the Dacic Basin

13.00-14.00 Lunch in Pleşcoi

14.00 – Departure to Bucharest

20.00 Dinner in Bucharest

1st of October

List of Participants

ESF – Funded Students

Nr.	Family Name	First Name	Country	Institute	Project
1	Briceag	Andrei	Romania	GeoEcoMar, Bucharest	SourceSink
2	Cazacu	Camelia	Romania	GeoEcoMar, Bucharest	SourceSink
3	Cojocaru	Loredana	Romania	University of Bucharest	SourceSink
4	Costriiciuc	Olga	Romania	University of Bucharest	SourceSink
5	Floroiu	Alina	Romania	University of Bucharest	SourceSink
6	Manta	Tanislav	Romania	University of Bucharest	SourceSink
7	Maximov	Gabriela	Romania	GeoEcoMar, Bucharest	SourceSink
8	Mirea	Adriana	Romania	University of Bucharest	SourceSink
9	Munteanu	Ioan	Romania	University of Bucharest	SourceSink
10	Okay	Seda	Turkey	Institute of Marine Sciences and Technology (D.E. University Izmir)	SourceSink

11	Savi	Sara	Switzerland	Institute of Geological Sciences, University of Bern	SedyMont
12	Sopkova	Bohuslava	Slovak Republic	Comenius University of Bratislava	SourceSink
13	Stojadinovič	Uros	Netherlands	Vrije Universiteit Amsterdam	SourceSink
14	Sujan	Michal	Slovak Republic	Comenius University of Bratislava	SourceSink
15	ter Borgh	Marten	Netherlands	Vrije Universiteit Amsterdam	SourceSink

Lecturers, Organizers and Senior participants

Nr.	Family Name	First Name	Country	Role	Institute
1	Dinu	Cornel	Romania	Lecturer	University of Bucharest
2	Francu	Juraj	Czech Republic	Lecturer	Czech Geological Survey
3	Garcia-Castellanos	Daniel	Spain	Lecturer	Instituto de Ciencias de la Tierra Jaume Almera (CSIC) Barcelona
4	Jipa	Dan	Romania	Organizer	GeoEcoMar, Bucharest
5	Kováč	Michal	Slovak Republic	Lecturer	Comenius University of Bratislava
6	Lericolais	Gilles	France	Lecturer	IFREMER, Brest
7	Melinte	Mihaela	Romania	Organizer	GeoEcoMar, Bucharest
8	Olariu	Cornel	USA	Lecturer	University of Texas at Austin, Jackson School of Geosciences
9	Panin	Nicolae	Romania	Lecturer	GeoEcoMar, Bucharest
10	Rădan	Silviu	Romania	Participant	GeoEcoMar, Bucharest
11	Stoica	Marius	Romania	Participant	University of Bucharest

Background reading – references

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