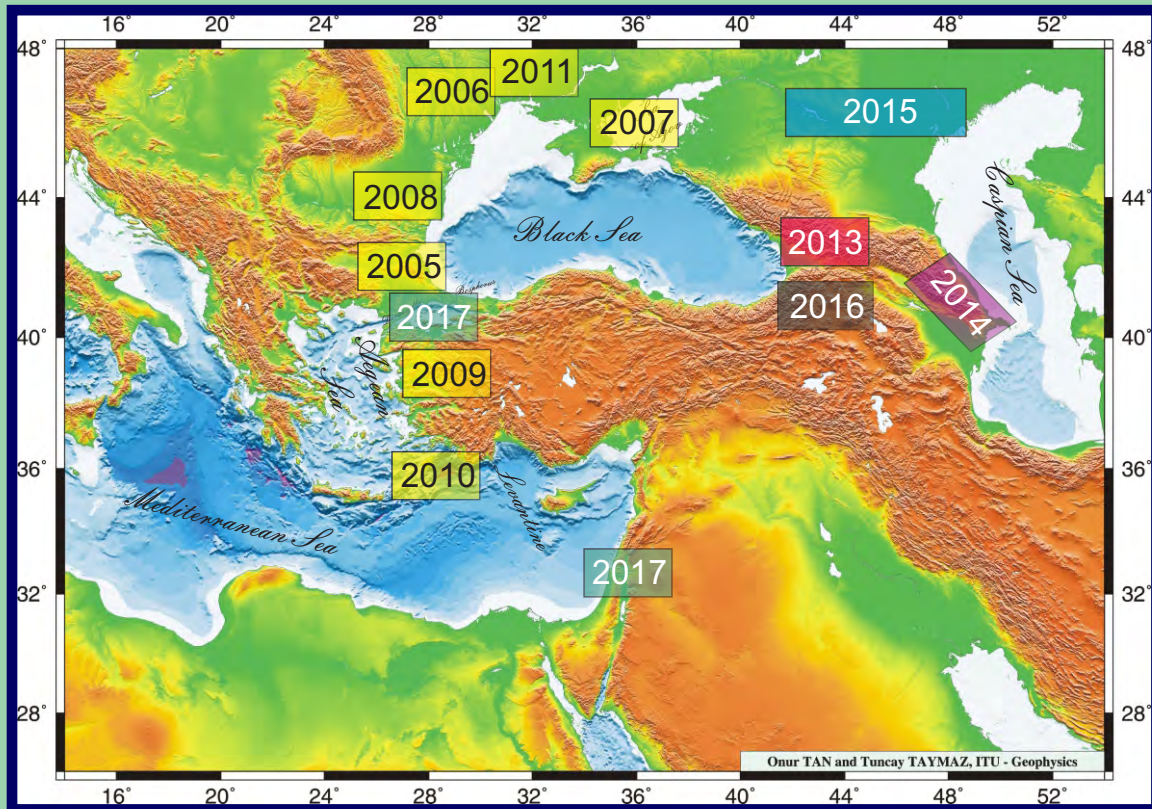




# Georgian National Academy of Sciences, Department of Earth Sciences, Tbilisi, Georgia

## 2-9 October 2016

### INTERNATIONAL GEOSCIENCE PROGRAMME



## Proceedings of the Fourth Plenary Conference

IGCP 610 "From the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary" (2013 - 2017)

<http://www.avalon-institute.org/IGCP610>



# IGCP 610 Fourth Plenary Conference and Field Trip, Tbilisi, Georgia, 2-9 October 2016

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## PROCEEDINGS

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# PROCEEDINGS

## **IGCP 610 Fourth Plenary Conference and Field Trip**

**“From the Caspian to Mediterranean:  
Environmental Change and Human Response  
during the Quaternary”  
(2013 - 2017)**

**<http://www.avalon-institute.org/IGCP610>**

Tbilisi ◆ Georgian National Academy of Sciences ◆ 2016

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## CONTENTS

Organizing and Executive Committee .....	ix
Scientific Committee.....	ix
International Advisory Committee.....	ix
Editorial Board of Field Trip Guide.....	x
Editorial Board of QI Special Volume.....	x
Aims and Scope.....	x
Welcome.....	xii
Venue .....	xii
Acknowledgments.....	xiii
PART 1.	
IGCP 610 Progress Report (2013-2015) .....	1
<i>Yanko-Hombach, V.</i>	
PART II. PROCEEDINGS	
Preliminary magnetometric investigation at Calatis archaeological site .....	17
<i>Anghel, S.</i>	
History of Caspian Sea level oscillations in the Late Pleistocene (if there was a Great Khvalynian transgression and a deep Atelian regression?).....	22
<i>Badyukova, E.N.</i>	
Methods of obtaining data on the characteristics of superficial and subsurface structures of the earth by remote sensing in the short-wave range of radio waves.....	26
<i>Belov, S.Yu., and Belova, I.N.</i>	
Pioneer dendroclimatological research in western and southwestern Turkmenistan using <i>Juniperus turcomanica</i> B. Fedtsch.....	30
<i>Berdnikova, A.A., Matskovskiy, V.V., and Kurbanov, R.N.</i>	
Preliminary results of palynological analysis of the Atelian deposits from a borehole core in the northern Caspian Sea.....	35
<i>Bolikhovskaya, N.S., Mamontov, D.A., Yanina, T.A., and Sorokin, V.M.</i>	
The palynoclimatostratigraphy of the Pleistocene deposits in Trlica Cave and environmental reconstructions (the northern Mediterranean, Montenegro) .....	39
<i>Bolikhovskaya, N.S., and Shunkov, M.V.</i>	
Middle Miocene marine mollusks in northernmost Anatolia: Biostratigraphic responses to changing paleogeography.....	43
<i>Büyükmeriç, Y., and Ilgar, A.</i>	
Quaternary molluscan faunas of the Sinop peninsula (N. Turkey) elucidate biogeographic connections.....	45
<i>Büyükmeriç, Y., and Yildirim, C.</i>	
Re-assessing East Mediterranean sea-level trends: 3000 years of archaeological indicators in Greece and Israel.....	48
<i>Dean, S., Sivan, D., Evelpidou, N., Baika, K., Cahill, N., Bechor, B., and Spada, G.</i>	

The value of the hydrological and landscape characteristics of the region for the life of the primitive population (an example of late-Mesolithic and Neolithic sites of Dnieper Rapids Region).....	51
<i>Demchenko, O.V.</i>	
The Sea of Azov under anticipated sea-level rise .....	56
<i>Dikarev, V.A.</i>	
General Tectonic/Geologic Framework of the Caspian Sea and its water connection with the Black Sea and Mediterranean.....	60
<i>Ergün, M.</i>	
The evolution of the Akchagylian Sea area and coastline based upon mathematical modeling .....	63
<i>Esin, N.I., Esin, N.V., Yanko-Hombach, V., and Frolov, A.S.</i>	
Late Neogene Sediments, Petrography, Facies, and Depositional Environments, South Kakheti, Georgia .....	66
<i>Gagnidze, N.</i>	
Geological structure of Georgia and geodynamic evolution of the Caucasus .....	69
<i>Gamkrelidze, I.P.</i>	
The Last Interglacial vegetation patterns on the northern margins of the Black Sea.....	76
<i>Gerasimenko, N.</i>	
The Structure and Geochemistry of the Kila-Kupra Mud Volcano (Georgia).....	79
<i>Glonti (Bacho), V., Koiava, K., Kotulová, J., and Kvaliashvili, L.</i>	
Climate change and paleoenvironmental events in the Bulgarian Black Sea zone during the Late Pleistocene.....	81
<i>Hristova, R.I.</i>	
Diatom analysis of Maikopian deposits of the west border of the South Caspian depression (along the section of Shikhzagirli Shamakhi-Gobustanzone) and some paleoecological conclusions .....	84
<i>Kerimova, N.T.</i>	
The origin of artifacts of bone and shell from the Khvalynsk Eneolithic cemeteries (Northern Caspian region) .....	89
<i>Kirillova, I., Yanina, T., Levchenko, V., Ippolitov, A., and Shishlina, N.</i>	
Morphological analysis of flat-bottomed depressions, the eastern Azov Sea region.....	93
<i>Konstantinov, E.A., Kurbanov, R.N., and Zaharov, A.L.</i>	
Research into glacier variation dynamics in East Georgia under the impact of modern climate change.....	96
<i>Kordzakhia, G., Shengelia, L., Tvauri, G., and Dzadzamia, M.</i>	
Porosity and deterioration of stone building material in Istanbul .....	101
<i>Küçükkaya, A.G.</i>	
New results on structure of the SrednYaya Akhtuba reference section.....	104
<i>Kurbanov, R.N., Yanina, T.A., Murray, A.S., Makeev, A.O., Rusakov, A.V.</i>	
<i>Streletskaya, I.D., Tkach, N.T., Sychev, N.V., and Bagrova, S.M.</i>	
Analysis of South Caspian deep sedimentation from marine cores .....	108
<i>Lahijani, H., Abbasian, H., and Naderi, A.</i>	

Pedogenetic response to climatic fluctuations within the last glacial-interglacial cycle in the lower Volga basin.....	111
<i>Makeev, A., Rusakov, A., Bagrova, S., Kurbanov, R., and Yanina, T.</i>	
Clay mineral provenance of Lower Khvalynian deposits in the Middle and Lower Volga River valley .....	115
<i>Makshaev, R.R., Svitoch, A.A., Khomchenko, D.S., and Oshchepkov, G.V.</i>	
Palynology of Sarmatian clay at Eltigen, Kerch Peninsula: first report.....	117
<i>Mudie, P.J.</i>	
Palynology of surface samples, Ukrainian shelf, NW Black Sea: first report .....	120
<i>Mudryk, I., Mudie, P. J., and Zolotarev, G.</i>	
Pollen-based reconstruction of the Plio-Pleistocene vegetation and climate change in the North Caucasus .....	124
<i>Naidina, O.D.</i>	
Pliocene-Quaternary Samtskhe-Javakheti Volcanic Highland, Lesser Caucasus – as a result of mantle plume activity.....	127
<i>Okrostsvaridze, A., Popkhadze, N., Bluashvili, D., Chang, Y. H., and Skhirtladze, I.</i>	
Quaternary Continental flood basalts of the Javakheti Volcanic Plateau, Lesser Caucasus - Reason of Mass Extinction?.....	130
<i>Okrostsvaridze, A.</i>	
Unique cave city Vardzia, Georgia – geology, destruction processes and protective measures .....	132
<i>Okrostsvaridze, A., Elashvili, M., and Kirkitadze, G.</i>	
Geometry and kinematic evolution of a thrust-top basin: an example from the western part of the Kura foreland fold and thrust belt, Georgia .....	136
<i>Razmadze, A., and Alania, V.</i>	
Vegetational and climatic changes recorded in pollen assemblages of the Late Holocene deposits from Lake Chokrak (Crimea).....	138
<i>Rohozin, Ye.</i>	
Soils of Scythian settlements as paleoenvironmental archives in the area of Late Holocene migration pathways through the East European steppe .....	141
<i>Rusakov, A., Makeev, A., Puzanova, T., Khokhlova, O., Merzliakova, A., and Kurbanova, F.</i>	
Coastal laws in Turkey.....	144
<i>Sazak, Ş.</i>	
Paleoclimatic events of the Late Pleistocene and their reflection in the structural and material composition of loess-soil complexes (southern part of the Eastern European Plain) .....	145
<i>Sedayeva, K.M., Kurbanov, R.N., and Chen, S.</i>	
MalaCofauna of the Kerch Strait during the Late Pleistocene-Holocene: paleogeographical analysis.....	149
<i>Semikolennykh, D., Ignatov, E., Yanina, T., and Arslanov, Kh.</i>	
Retrospective data about underwater landscapes and the meiobenthos in the Northeastern part of the Black Sea.....	153
<i>Sergeeva, N.G.</i>	
Western Georgia as a refuge for Tertiary elements of Eurasian floras (using the example of the family Hamamelidaceae).....	156



<i>Shatilova, I.I., Rukhadze, L.P., and Kokolashvili, I.M.</i>	
Petrographic characteristics of the Productive Series of the Absheron peninsula on the basis of SEM-analysis and optical microscopy .....	158
<i>Shiraliyeva, S.F., and Amrakhov, R.R.</i>	
NorthWestern Black Sea Region at the LGM: searching for the sea impact on human adaptation .....	162
<i>Smyntyna, O.V.</i>	
Deep-sea Holocene sediments of the Mediterranean Sea, the Black Sea, and the Caspian Sea .....	166
<i>Sorokin, V., and Yanina, T.</i>	
Collections of the Central Soil Museum as a foundation for soil-ecological monitoring of the Caspian-Black Sea-Mediterranean Corridor territory .....	172
<i>Sukhacheva, E., and Rusakova, E.</i>	
The impact of regional geophysical factors on human blood counts in the Caspian Lowland .....	176
<i>Taumanova, G.E.</i>	
First optically stimulated luminescence dating results of Lower Volga sediments (Srednyaya Akhtuba section) .....	180
<i>Tkach, N.T., Murray, A.S., Kurbanov, R.N., Yanina, T.A., Svitoch, A.A., and Sychev, N.V.</i>	
Anthropology of the Caucasus of the Paleolithic Age .....	185
<i>Vasilyev, S.V.</i>	
Paleoanthropological research into the early medieval Coptic cemetery of Wadi Naqlun in the Fayoum Oasis (Egypt).....	188
<i>Vasilyev, S.V., and Borutskaya, S.B.</i>	
Malacofauna of the Volga delta basins and their paleogeographical importance.....	192
<i>Yanina, T., Svitoch, A., and Khomchenko, D.</i>	
Correlation of the paleogeographic events of the Caspian Sea and Russian Plain in the Late Pleistocene: New data .....	196
<i>Yanina, T., Sorokin, V., Svitoch, A., Kurbanov, R., Murray, A., Sychev, N., and Tkach, N.</i>	
Synthesis of the IGCP 610 results: some controversies and paradoxes.....	199
<i>Yanko-Hombach, V., and Kislov, A.</i>	
The Karangatian epoch (MIS 5e) in the Black Sea basin .....	202
<i>Yanko-Hombach, V., and Motnenko, I.</i>	
Foraminifera as indicators of environmental stress in marine ecosystems: New evidence from the Ukrainian Black Sea shelf .....	207
<i>Yanko-Hombach, V., Kovalyshina, S., and Kondariuk, T.</i>	
New results on the stratigraphy of Quaternary sediments of the Manych depression .....	213
<i>Yarovaya, S.K., Kurbanov, R.N., Yanina, T.A., Garankina, E.V., Belyaev, V.R., and Garova, E.S.</i>	
INDEX .....	216

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## AIMS AND SCOPE

The main goal of the IGCP 610 Project is to provide cross-disciplinary and cross-regional correlation of geological, archaeological, environmental, and anthropological records in order to (a) explore interrelationships between environmental change and human adaptation during the Quaternary, (b) create a networking and capacity-building structure to develop new interdisciplinary research initiatives, and (c) provide guidance to heritage professionals, policy makers, and the wider public on the relevance of studying the Caspian-Black Sea-Mediterranean Corridor [“CORRIDOR”] for a deeper understanding of Eurasian history, environmental changes and their relevance, as well as past and future impacts on humans.

The “CORRIDOR” is perfectly suited for these purposes. (1) It encompasses the large chain of intercontinental basins—the Caspian, Black (together called Ponto-Caspian), Marmara, Aegean, and Eastern Mediterranean (Levantine) seas—with their connecting straits and coasts. Here, sea-level changes are clearly expressed due to geographical location and semi-isolation from the World Ocean, which makes the “CORRIDOR” a paleoenvironmental amplifier and a sensitive recorder of climatic events. Periodic connection/isolation of the basins during the Quaternary predetermined their specific environmental conditions and particular hydrologic regimes, and thus, the area, and especially the Ponto-Caspian, represents a “natural laboratory” to study the responses of semi-isolated and isolated basins to GCC. (2) It has rich sedimentary and geomorphologic archives that document past environmental changes. (3) It has a substantial archaeological, anthropological, and historical record. (4) It is easily accessible for study.

To achieve the main goal and objectives, the Project incorporates six dimensions, each addressed by integrating existing data and testing of hypotheses: 1. The geological dimension examines the sedimentary record of vertical sea-level fluctuations and lateral coastline change. 2. The paleoenvironmental dimension integrates paleontological, palynological, and sedimentological records to reconstruct paleolandscapes. 3. The archaeological dimension investigates cultural remains. 4. The paleoanthropological dimension studies responses of different *Homo* species to environmental change. 5. The mathematical dimension provides

GIS-aided mathematical modeling of climate and sea-level changes, and human dispersal linked to paleoenvironmental variation that can be meaningfully compared with current global changes. 6. The geo-information dimension grasps the "big picture" of geoarchaeological events over the duration of the Quaternary. Particular attention will be given to synthesizing the wealth of literature published in local languages, stored in archives, and largely unknown or ignored in the West.

Study sites include the Caspian, Azov-Black Sea, Marmara, and Eastern Mediterranean. These sites are characterized by rich sedimentary, geomorphological, archaeological, paleoanthropological, and historical records providing a superb opportunity to assess the influence of climate and sea-level change on human development.

Six Plenary Conferences and Field Trips are planned in the following regions: 2013 – Western Georgia; 2014 – Azerbaijan and Russia (Dagestan); 2015 – Russia (Northern Caspian and Manych Outlet); 2016 – Eastern Georgia (Inner Kartli and Kakheti regions); 2017 – Israel (Eastern Mediterranean), Turkey (around the Sea of Marmara), and/or possibly Turkmenistan (under consideration). They are scheduled for the third quarter of each year. Prior to each Conference and Field Trip, the Conference Proceedings and Field Trip Guide are prepared. Each Plenary Conference provides a forum for dialogue between multidisciplinary specialists in the Quaternary history of the "CORRIDOR" and other workers in related areas. The Field Trips follow the Plenary Meetings (Fig. 1).

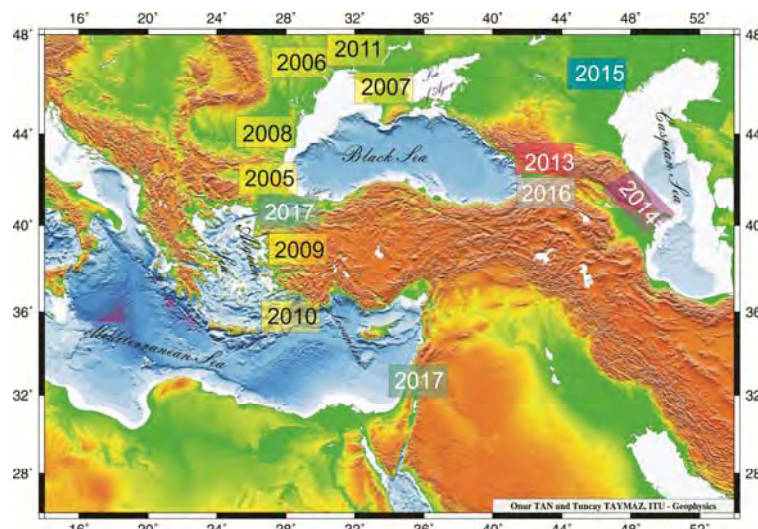


Figure 1. The Caspian-Black Sea-Mediterranean "CORRIDOR": in yellow are the locations of IGCP 521-INQUA 501 meeting and field trip sites (2005-2011); in other colors are sites to be studied by the present IGCP 601 Project: 2013 – Tbilisi, Western Georgia; 2014 – Baku, Azerbaijan; 2015 - Astrakhan' (Volga Delta), Russia; 2016 – Tbilisi, Eastern Georgia; 2017 – Haifa, Israel, and Istanbul, Turkey.

They are focused on observation of geological characteristics of Quaternary stratotypes as well as key archaeological and paleontological sites. All of them are easily accessible for study and can be sampled during the Field Trips for further investigation in various laboratories around the world.

The Fourth Plenary Meeting and Field Trip will focus on the pre-Pleistocene and Pleistocene geological history of the Eastern Paratethys remnants within Eastern Georgia. This subject is very important in shedding light and achieving a better understanding of a possible mechanism of separation of the Eastern Paratethys into the individual seas leading to formation of the Black and Caspian Seas.

It is expected that the meeting will bring together multidisciplinary scientists from all over the world to enhance the West-East scientific dialogue and provide a foundation for collaboration on correlation and integration on the subject of the conference as previous IGCP 610 meetings have done.

The meeting will cover eight days. Two days (3-4 October) will be spent in Technical Sessions, and four days (5-8 October) will be dedicated to the Field Trips.

## **WELCOME**

On behalf of the Organizing and Executive Committees as well as the Georgian National Academy of Sciences (GNAS), Ilia State University, Georgia, and Avalon Institute of Applied Science, Canada, we are delighted to welcome you to the IGCP 610 Forth Plenary Conference and Field Trip being held on 2-9 October 2016 in Georgia.

This conference is the fourth in a series of IGCP 610 Plenary Conferences and Field Trips. It is expected that IGCP 610 conferences will bring together multidisciplinary scientists from all over the world and in the process enhance West-East scientific dialogue by providing a supportive background for collaboration regarding the correlation and integration of discoveries on the influence of climatically/tectonically induced sea-level changes and coastline migration on humanity. This is an area of strategic importance not only for all coastal countries but also for at least 17 other countries sharing a drainage basin that is one-third the size of the European continent.

The Fourth Plenary Conference and Field Trip has been organized and sponsored by the Georgian National Academy of Sciences (GNAS), the Ilia State University, Georgia, and Avalon Institute of Applied Science, Winnipeg, Canada; with very moderate financial contributions from IGCP.

We are happy to welcome to Georgia distinguished specialists and students in the Humanities, Earth, and Life Sciences from countries around the world.

We wish you a very pleasant stay in Georgia.

Sincerely,

*Organizing and Executive Committees of IGCP 610 Fourth Plenary Meeting and Field Trip*

## **VENUE**

Tbilisi is the capital and the largest city of Georgia, lying on the banks of the Kura River. The city was founded in the 5th century by Vakhtang Gorgasali, the monarch of Georgia's precursor Kingdom of Iberia, Tbilisi has served, over various intervals, as Georgia's capital for nearly 1500 years and represents a significant industrial, social, and cultural center of the country. Located on the southeastern edge of Europe, Tbilisi's proximity to lucrative east-west trade routes often made the city a point of contention between various rival empires throughout history, and the city's location to this day ensures its position as an important transit route for global energy and trade projects. Tbilisi's varied history is reflected in its architecture, which is a mix of medieval, classical, and Soviet structures. Historically, Tbilisi has been home to peoples of diverse cultural, ethnic, and religious backgrounds, though it is now overwhelmingly Eastern Orthodox Christian. Notable tourist destinations include cathedrals like Sameba and Sioni, classical Freedom Square and Rustaveli Avenue, medieval Narikala Fortress, the pseudo-Moorish Opera Theater, and the Georgian National Museum.

The Georgian National Academy of Sciences (GNAS), established in 1941, is an autonomous body financed by the Georgian government (Figs. 2, 3). GNAS is the highest scientific institution conducting and coordinating fundamental research in the natural sciences and the

humanities in Georgia. It oversees 9 scientific departments of the Academy (www.science.org.ge). GNAS has 61 members and 40 corresponding members. The Georgian National Academy of Sciences coordinates scientific researchers in Georgia and develops relationships with up to 20 Academies of foreign countries and other scientific countries. It is a scientific Adviser to the Georgian Government. GNAS oversees the richest depository of manuscripts and rare book collections in the country.



Figure 2. The main building of the Georgian National Academy of Sciences.

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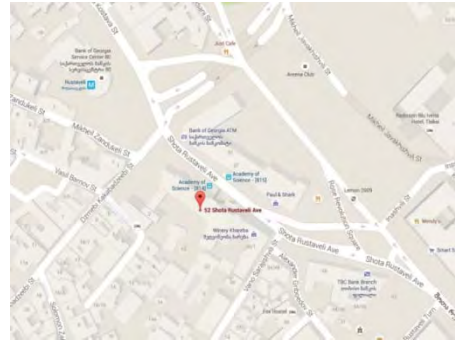


Figure 3. Location of the Georgian National Academy of Sciences.

## ACKNOWLEDGMENTS

We gratefully acknowledge the support and hospitality of the Georgian organizers, the Georgian National Academy of Sciences (GNAS), and the Ilia State University for hosting the IGCP 610 Fourth Plenary Conference and Field Trip, and providing us with their facilities to convene this conference. Support has also been received from the Avalon Institute of Applied Science, Canada. Financial contributions to underwrite the travel costs for young scientists from developing countries and countries in transition were kindly provided by IGCP.

We are indebted also to Academician Irakliy GAMKRELIDZE, Georgia, President of the Conference, Prof. Dr. Avtandil OKROSTSVERIDZE, Chairman of the Organizing Committee, Dr. Eteri KILASONIA, Executive Secretary for their extraordinary efforts in organizing the conference and field trips. Particular appreciation is extended to Acad.-member Michael Kakabadze, Dr. Nonna Gagnidze, Prof. Vakhtang Licheli, Doctorant Dr. David Bluashvili, Dr. Zurab Janelidze, Prof. Nikoloz Tushabramishvili, and Doctoral Student Lasha Sukhishvili, for arranging the Field Trips and preparing the Field Trip Guide.

We gratefully recognize the assistance of Prof. Allan GILBERT together with Prof. Dr. Valentina YANKO-HOMBACH for editing and layout of the Conference Proceedings.

To the Scientific Committee, we offer sincere thanks for evaluating submissions and managing the abstract review process. The Scientific Committee, in turn, wishes to thank the anonymous reviewers for their efforts in providing useful comments on submitted papers.

For her prompt action, we extend our appreciation to the Project and website administrator Dr. Irena MOTNENKO.

We are also very grateful to the journal *Quaternary International*, which has kindly invited us to publish the Georgia conference proceedings within their pages, just as it did for the IGCP 521 and INQUA 0501 projects.

*Prof. Dr. Valentina Yanko-Hombach, Co-Leader of IGCP 610*

**PART I.**  
**IGCP 610 PROGRESS REPORT (2013-2015)**

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<http://www.geoecomar.ro/website/proiecte.html>

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**1. List of countries involved in the project**

IGCP 610 community includes about 250 scientists from 22 countries: Azerbaijan, Belgium, Bulgaria, Canada, Georgia, Germany, Greece, France, Israel, Italy, Kazakhstan, Latvia, Romania, Russia, The Netherlands, Switzerland, Turkey, Turkmenistan, UK, Ukraine, and USA.

IGCP 610 Project investigates the influence of environmental change on the development of humankind for the entire Caspian-Black Sea-Mediterranean Corridor [“CORRIDOR”] that encompasses the Eurasian intercontinental basins of the Caspian, Black, Marmara, Aegean, and Eastern Mediterranean seas with their connecting straits and coasts (Fig. 1). During the Quaternary, these basins were repeatedly connected and isolated from each other. This predetermined their environmental conditions and hydrologic regimes and imposed specific impacts on diverse biological populations, including humans inhabiting the coastal domains.

The project commenced on 1 April 2013. Since that time, it has served as a focal point for correlation of scientific data obtained by research projects dealing with environmental change and human response in a variety of settings within the Caspian-Black Sea-Mediterranean Corridors [CORRIDORS] during the Quaternary. In general, two years of IGCP 610 activity have been carried out in a strict agreement with the Working Plan [[http://www.avalon-institute.org/IGCP610/work\\_plan.php](http://www.avalon-institute.org/IGCP610/work_plan.php)]. The one exception was the creation of the GIS-aided Interactive Data Base that was postponed until the end of the project.

Its main goal is to provide cross-disciplinary and cross-regional correlation of geological, archaeological, environmental, and anthropological records in order to (a) explore interrelationships between environmental change and human adaptation during the Quaternary, (b) create a networking and capacity-building structure to develop new interdisciplinary research initiatives, and (c) provide guidance to heritage professionals, policy makers, and the wider public on the relevance of studying the “CORRIDOR” for a deeper understanding of Eurasian history, environmental changes and their relevance, and likely future impact on humans.

This project has a triple focus: (1) geological history, (2) paleoenvironmental change (climate, sea level, coastline migration), and (3) human response (migration, subsistence strategy, physical and cultural adaptation, etc.) to environmental changes. Six dimensions of evidence are explored by integrating existing data and hypothesis testing: 1. The geological dimension examines the sedimentary record of vertical sea-level fluctuations and lateral coastline

change. 2. The paleoenvironmental dimension integrates paleontological, palynological, and sedimentological records to reconstruct paleolandscapes. 3. The archaeological dimension investigates cultural remains. 4. The paleoanthropological dimension studies responses of different *Homo* species to environmental change. 5. The mathematical dimension provides GIS-aided mathematical modeling of climate, sea-level change, and human dispersal linked to environmental change. 6. The geo-information dimension will try to grasp the "big picture" of geoarchaeological events throughout the Quaternary. Attention is constantly given to synthesizing the wealth of literature published in local languages, stored in archives, and largely unknown in the West.

This Project succeeds IGCP 521 "Black Sea-Mediterranean Corridor during the last 30 ky: sea level change and human adaptation" (2005-2010) that collected, integrated, and analyzed much scientific data and established a strong international team of multidisciplinary scientists from 32 countries. That Project examined the "CORRIDOR" for the last 30 ky only. The new IGCP Project begins in the early Quaternary, examining responses of pre-modern humans to environmental change, and includes the Central Asian basins thereby covering the Eurasian cascade more completely and involving scientists from countries farther east. It links Europe and Asia more closely in the successive conferences and field trips, and like its predecessor, the new Project improves our understanding of the geoscientific factors affecting global environment in order to improve human living conditions; increases understanding of geological processes and concepts of global climate change [GCC], including socially relevant issues; and improves standards, methods, and techniques of carrying out geological and archaeological research, including the transfer of geological and geotechnological knowledge between industrialized and developing countries.

The Project's wide scope provides a superb opportunity to collaborate with other ongoing/past projects, as well as the MAB Programme of the UNESCO Strategy for Action on Climate Change, LOICZ, IGBP, and especially with SPLASHCOS, in which two co-leaders of this Project (V. Yanko-Hombach and O. Smytyna) were members of the Management Committee. The Project complements the IGU Commission on Coastal Systems, INQUA CMP, and TERPRO Commissions, with which IGCP 521 cooperated previously through the INQUA 501 project, as well as the HaBCom, SACCOM, and PALCOMM Commissions. The Project also collaborates with geological surveys, archaeological expeditions, and corresponding museums in all countries bordering the "CORRIDOR."

The Project is linked to the EU-ITN programme "Drivers of Pontocaspian biodiversity rise and demise"; EU-WAPCOAST BS-ERA.NET 076 "Water Pollution Prevention Options for Coastal Zones and Tourist Areas: Application to the Danube Delta Front Area"; ICOMOS - The International Council on Monuments and Sites; COCONET "Towards COast to COast NETWORKS of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential"; SPLASHCOS "Submerged Prehistoric Archaeology and Landscapes of the Continental Shelf"; "Study of the formation processes and spatial distribution of methane in the Black Sea and theoretical considerations of their influence on basin eco- and geosystems," supported by the Ministry of Education and Science of Ukraine; and "Paleogeographical evolution of the Gulf of Taman with special regard to the underwater excavations in Phanagoria" funded by the University of Cologne and Russian Foundation for Basic Research (RFBR); and the series of projects supported by RFBR: № 14-05-00227 "Environmental evolution of the Caspian and Black Sea under the multiscale changes of climate", № 13-05-00086 "Pont-Manych-Caspian oceanographic system in the late Pleistocene: Systematics and correlation of events, evaluation of character and degree of interaction, paleogeographic consequences in the region", № 13-05-00242 "Radioisotope stratification of age and synchronization of the Quaternary deposits of the Ponto-Caspian", №



13-05-00625 “Peculiarities of the evolution of relief in the Northern Caspian region in the late Pleistocene: Main stages of the development, chronology, and correlation with climatic rhythms in the Black Sea-Caspian region”, № 14-05-00227 “Regularities of evolution of environment of the Caspian Sea and the Black Sea in the conditions of multi-scale climate changes”?; and several others. Disseminating the project events and activities via regular updating of Project websites and mailing list of the project contributors, which increased from 957 in 2013 to 1054 in 2014, as well as social networks (Facebook for English and non-English-speakers, and Вконтакте for mostly Russian speakers) <https://www.facebook.com/groups/180481035443572/>, [http://vk.com/album115218532\\_181815723](http://vk.com/album115218532_181815723).

## 2. Plenary Conferences and Field Trips

The First Plenary Conference and Field Trip of IGCP 610 was organized by the Institute of Earth Sciences, Iliia State University and the Avalon Institute of Applied Science, Winnipeg, Canada, and hosted by Iliia State University, on 12-19 October 2013, in Tbilisi, Georgia (Yanko-Hombach, 2016). President of the conference was Prof. Zurab Javakhishvili. Executive Director was Prof. Valentina Yanko-Hombach. One hundred and fifty one scientists from 19 countries contributed to the conference; 66% of them were from developing countries (Fig. 1). Their peer-reviewed contributions are assembled in a 182-page Conference Proceedings volume (Gilbert and Yanko-Hombach, 2013).

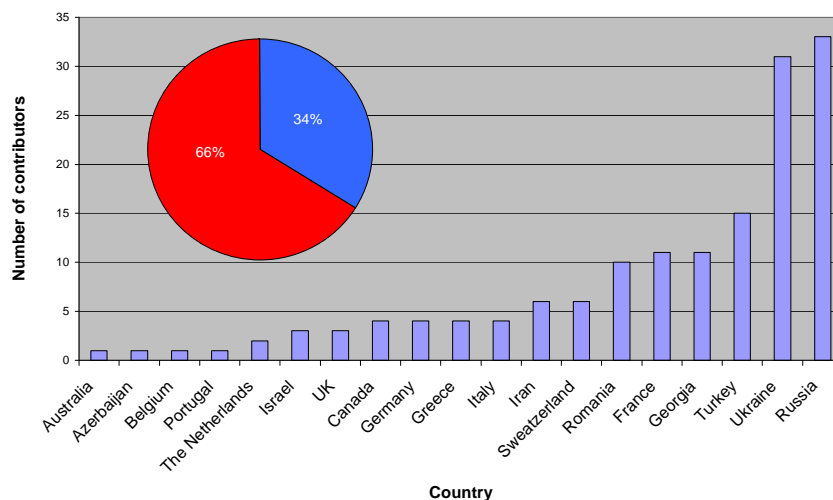


Figure 1. Number of countries and contributors to IGCP 610 First Plenary Conference and Field Trips. The circle shows the percentage of scientists from developing (red) and developed (blue) countries, respectively.

The two days of Technical Sessions were organized into four panels and five Oral/Poster sessions. Panel 1 was titled “STRATIGRAPHY AND PALEOENVIRONMENTAL RECONSTRUCTIONS” (Moderators: Nikolay Panin, Romania, and Andrei Chepalyga, Russia) and included 24 presentations with two key-note talks by Prof. Teller (Canada) and Prof. Okrostsvardize with co-authors (Georgia). The presentations covered a wide range of topics including Quaternary geomorphology, geology, stratigraphy, paleogeography, volcanism, seismicity, and mineral resources of the Ponto-Caspian and Marmara region. Panel 2 was titled “RECENT ECOSYSTEMS” (Moderators: Nelly Sergeeva, Ukraine, and Valentina Yanko-Hombach, Ukraine, Canada) and included four presentations on recent fauna of the Black Sea. Panel 3 was titled “ARCHAEOLOGY, HISTORY, AND ETHNOLOGY” (Moderators: Nikoloz Tushabramishvili, Georgia, and Olena Smyntyna, Ukraine) and included ten presentations. The presentations covered a wide range of topics,

such as Paleolithic of Georgia, new data on Oldowan migration to Europe via the northern Black Sea Corridor in the light of the latest discoveries in the northern Caucasus and Dniester Valley, the Aegean route: an alternative route for Neanderthals and Anatomically Modern Humans (AMHs) traveling from Asia to Europe and vice-versa. Panel 4 was entitled “MODELING” (Moderators: Nikolay Esin and Alexander Kislov, Russia) and included four presentations, such as a mathematical model of Black Sea coast and shelf evolution during the Quaternary period, etc.

The POSTER session included 17 posters that were organized into five topics: GEODYNAMICS AND ACTIVE TECTONICS (Moderator: Hayrettin Koral, Turkey), RECENT ECOSYSTEMS (Moderators: Nelly Sergeeva, Ukraine, and Valentina Yanko-Hombach, Ukraine, Canada), SEA LEVEL CHANGES AND PALEOENVIRONMENTAL RECONSTRUCTIONS (Moderators: Nikolay Panin, Romania, and Andrei Chepalyga, Russia), and PALYNOLOGY AND PALEONTOLOGY (Moderators: Petra Mudie, Canada, and Valentina Yanko-Hombach, Ukraine, Canada), ARCHAEOLOGY, HISTORY, and ETHNOLOGY (Moderators: Nikoloz Tushabramishvili, Georgia, and Olena Smyntyna, Ukraine). The Technical Sessions were followed by the Round Table that enabled the formation of 12 Working Groups for the Project and the selection of their coordinators. It also led to decisions about the future strategy in running the project. For more details see the Conference Programme.

The four days of field trips (by bus) were led by prominent Georgian geologists and archaeologists (Okrostsvardize et al., 2013) and were focused on the Eopleistocene geological sequence of Tsvermaghala Mountain that represents a stratotype of the Gurian Chauda; it possesses a thickness exceeding 1000 m deposited prior to the Matuyama-Brunhes Reversal (i.e., 780 ka BP) as well as archaeological sites of Lower to Upper Paleolithic age that include Dmanisi, Mashavera Gorge, Tetrtskaro, Tsalka-Bedeni Plateau, Faravani Lake, Akhalkalaki, Diliska, Chiatura, Bondi Cave, Undo Cave, Djrchula Gorge, as well as the Neolithic site Samele Cave and Medieval-Roman site Vardzia Cave (Fig. 2).



Figure 3. Map of Georgia with geological and archaeological sites visited during the Field Trips of IGCP 610 in 2013. Field Trip I (15 October 2013): Mtskheta, Chiatura Paleolithic sites, Sataplia dinosaur footprints, and cave state reserve. Field Trip II (16 October 2013): Mtskheta, Chiatura Paleolithic sites, Sataplia dinosaur footprints, and cave state reserve. Field Trip III (17 October 2013): Paliastomi Lake, Tsvermaghala Chaudian Black Sea Terrace, Batumi seashore. Field Trip IV (18 October 2013): Dzirula massif, Borjomi, Vardzia Cave Town and Quaternary Abul-Samsari volcanic ridge.

The Second Plenary Conference and Field Trip of IGCP 610 was organized by the Institute of Geology and Geophysics of the Azerbaijan National Academy of Sciences ([www.gia.az](http://www.gia.az)) and the Avalon Institute of Applied Science, Winnipeg, Canada, and hosted by the Institute of Geology and Geophysics, on 12-20 October 2014, Baku, Azerbaijan (Yanko-Hombach, 2016). President of the conference was Corresponding Member of the Azerbaijan Academy of Sciences Prof. Elmira Aliyeva. Executive Director was Prof. Valentina Yanko-Hombach. One hundred and twenty four scientists from two continents and 18 countries contributed to the conference; 71% of them were from developing countries (Fig. 3). Their peer-reviewed contributions are assembled in a 186-page Conference Proceedings volume (Gilbert and Yanko-Hombach, 2014).

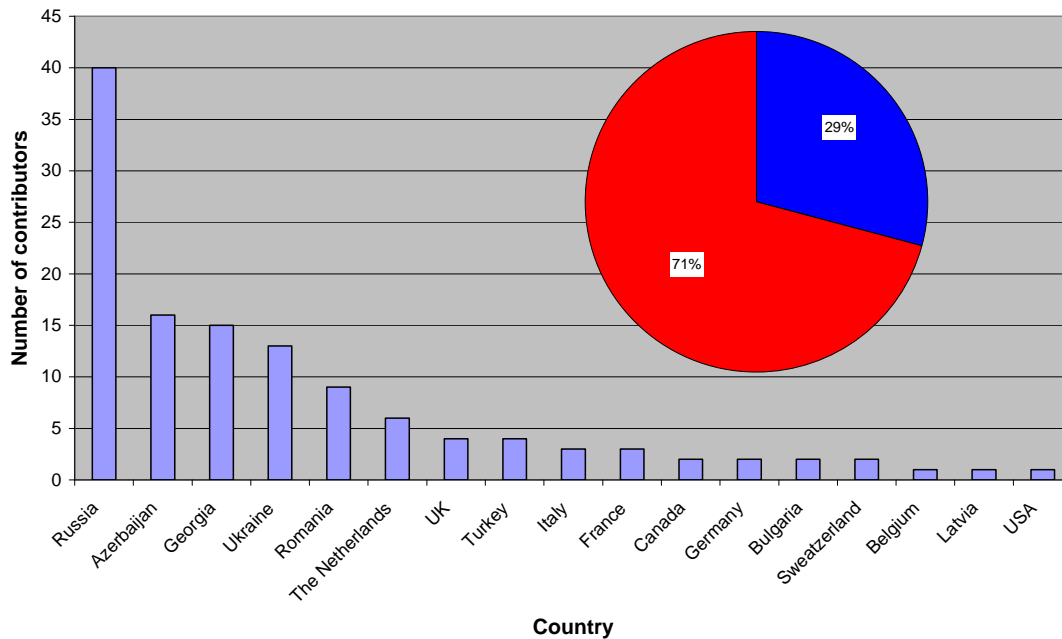


Figure 3. Number of countries and contributors to the IGCP 610 Second Plenary Conference and Field Trips in Baku, Azerbaijan. The circle shows the percentage of scientists from developing (red) and developed (blue) countries, respectively.

The meeting was focused on the whole spectrum of Quaternary geological sequences exposed in the terraces and ridges of the Caspian region. This includes the stratotype of the Mountain of Bakinian stage (ca. 600–450 ka BP) located in the suburbs of Baku on the Absheronian Peninsula; major exposures in the southwestern part of the peninsula of Garagush mountain, Bakinskie Ushi. This includes outcrops of Quaternary deposits at Garamaryam and Turianchay in the Ajinour region, and Bozdag located in the Middle Kura region, which is a reference section of the marine sediments of the Bakinian stage in western Azerbaijan. The Neogene-Quaternary boundary as well as the Matuyama-Brunhes Reversal with Olduvai and Jaramillo episodes were traced. The archaeological sites in Gobustan with its famous petroglyphs of Mesolithic age were observed. Plans included visits to some archaeological and historical places in Baku: the Shirvanshakh Palace constructed during the period from the XIIIth to the XVIth century; the Maiden Tower (the most mysterious monument of Baku) of which the unique construction has no analogs in the East. The Palace complex and Maiden Tower are included in the UNESCO list of World heritage sites. The participants also visited the historical-cultural reserve of Lagich that dates from the XV-XIX centuries, the first Christian Church in the Caucasus dated to the Ist century, excavations of an ancient town located in the suburbs of Gabala city, which for six centuries (until the VIth century) was the

capital of Caucasian Albania, and famous for the beautiful wall paintings of Khan Palace in the old Sheki town.

The two days of Technical Sessions were organized into five panels and five Oral/Poster sessions. Panel 1 was titled “RECENT ECOSYSTEMS AND PROCESSES”—moderators: Nelly Sergeeva (Russia) and Valentina Yanko-Hombach (Ukraine, Canada)—and included five ORAL presentations. The presentations covered a range of topics on recent environments and ecosystems of the Caspian-Black Sea-Mediterranean Corridors. Panel 2 was titled “STRATIGRAPHY, PALEONTOLOGY, AND PALEOENVIRONMENTAL RECONSTRUCTIONS”—moderators: Nikolay Panin (Romania) and Andrey Chepalyga (Russia) —and included 19 ORAL presentations with a key-note talk by Profs. Yanina and Svitoch (Russia). The presentations covered a range of topics on Quaternary ecostratigraphy and paleogeographic reconstructions of the Ponto-Caspian and Marmara region. Panel 3 was titled “TECTONICS”—moderator: Hayrettin Koral (Turkey)—and included three presentations on the earthquakes of Eastern Turkey, interrelationships between sea-level changes and tectonics along the southern Black Sea coasts of Turkey, and modern active tectonics in Azerbaijan. Panel 4 was titled “MODELING”—moderators: Nikolay Esin and Alexander Kislov (Russia)—and included five presentations devoted to modeling of coastline migration, climate change and infilling of the Black Sea by Mediterranean salt water over the course of the Holocene transgression. Panel 5 was titled “ARCHAEOLOGY, HISTORY, AND ETHNOLOGY” —moderators: Andrey Chepalyga (Russia) and Olena Smyntyna (Ukraine)—and included five presentations with a key-note talk by I. Babaev (Azerbaijan). The presentations were devoted to the North Black Sea passageway for the first peopling of Europe, ties between Southeast Caucasus and Mediterranean countries in antiquity, influence of paleoecological changes on migration and economic activities of the Neolithic people of Azerbaijan, and archaeological landscape of Gobustan at the end of the upper Pleistocene and early Holocene.

The POSTER session included 23 poster presentations that were organized into five topics: GEOMORPHOLOGY—moderator: Ekaterina Badyukova (Russia); RECENT ECOSYSTEMS AND ENVIRONMENTAL MONITORING—moderators: Nelly Sergeeva (Russia) and Valentina Yanko-Hombach (Ukraine, Canada); SEA LEVEL CHANGES AND PALEOENVIRONMENTAL RECONSTRUCTIONS—moderators: Nikolay Panin (Romania) and Andrey Chepalyga (Russia); PALYNOLOGY AND PALEONTOLOGY—moderators: Petra Mudie (Canada) and Valentina Yanko-Hombach (Ukraine, Canada); ARCHAEOLOGY, HISTORY, AND ETHNOLOGY—moderators: Mehmet Özdoğan (Turkey) and Olena Smyntyna (Ukraine). The Technical Sessions were followed by the Round Table that enabled participants to discuss the progress of IGCP 610 and to plan future strategy in running the project. For more details see the Conference Programme.

The five days of field trips (by bus) were led by prominent Azerbaijani geologists and archaeologists and were focused on the Apsheronian stage sediments, the classic stratotype of the Mountain of Bakinian stage, examples of the rapid Caspian Sea level changes in the Pleistocene successions, Azerbaijan mud volcanoes, Western Azerbaijan and the Greater Caucasus continuous outcrop of Quaternary continental sediments of the Ajinour, reference outcrop of the marine Bakinian sediments at Bozdag, as well as archaeological sites of Gobustan, Gabala, and historical sites of Baku and Lagich (Fig. 4; Aliyeva and Kengerli, 2014).



Figure 4. Map of Azerbaijan with geological and archaeological sites visited during the Field Trips of IGCP 610 in 2014. Field Trip 1 (15 October 2014): Stop 1.1. The Maiden Tower and Shirvan Shakh Palace; Stop 1.2. The Bakinskies Ushi; Stop 1.3. The Garagush mountain. Field Trip 2 (16 October 2014): Stop 2.1. Classic stratotype of the Mountain of Bakinian stage, examples of the rapid Caspian Sea level changes in the Pleistocene successions; Stop 2.2. Mud volcano Dashgil; Stop 2.3. Gobustan National Park. Field Trip 3 (17 October 2014): Stop 3.1. Outcrop Padar “windows.” Continental sedimentation. Stop 3.2. Historical village Lagich. (18 October 2014): Stop 4. Exposure of the Quaternary continental and marine sediments of Ajinour (outcrop Turianchay). Field Trip 5 (19 October 2014): Stop 5.1. Khan palace in Sheki town and historical museum; Stop 5.2. Reference outcrop of the marine Bakinian sediments at Bozdag. Field Trip 6 (20 October 2014): Stop 6. Ancient town of Gabala and Archeological Museum.

The Third Plenary Conference and Field Trip of IGCP 610 was organized by the M.V. Lomonosov Moscow State University, Astrakhan State University, Astrakhan Museum-Reserve, Russia, and the Avalon Institute of Applied Science, Winnipeg, Canada, and hosted by the Astrakhan Museum-Reserve. President of the conference was Prof. Tamara Yanina. Executive Director was Prof. Valentina Yanko-Hombach. The Meeting and Field Trip were held in the Northern Caspian region in the city of Astrakhan and the Astrakhan region. One hundred seven scientists from 14 countries contributed to the conference; 77% of them were from developing countries (Fig. 5). Their peer-reviewed contributions are assembled in a 220-page Conference Proceedings volume (Gilbert et al., 2015).

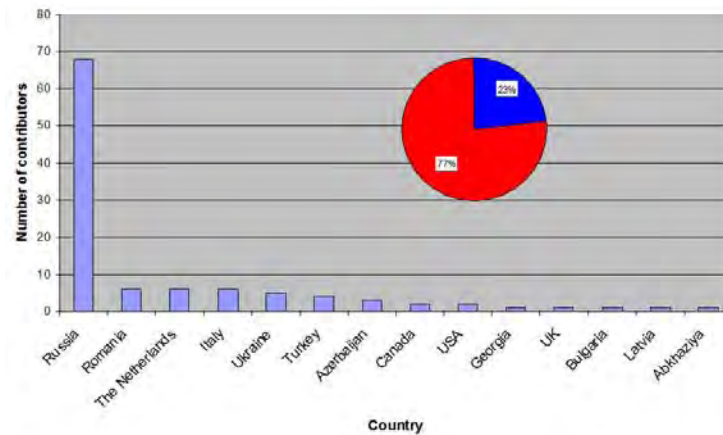


Figure 5. Number of countries and contributors to IGCP 610 Third Plenary Meeting and Field Trips. The circle shows the percentage of scientists from developing (red) and developed (blue) countries, respectively.

The two days of Technical Sessions were organized into five panels and five Oral/Poster sessions. Panel 1 was titled “PANEL 1: RECENT ECOSYSTEMS AND PROCESSES”—moderators: Nelly Sergeeva (Russia) and Valentina Yanko-Hombach (Ukraine, Canada)—and included three ORAL presentations. The presentations covered a range of climate, precipitation, and faunal migration in the “CORRIDORS.” Panel 2 was titled “STRATIGRAPHY, PALEONTOLOGY, AND PALEOENVIRONMENTAL RECONSTRUCTIONS”—moderators: Nikolay Panin (Romania) and Andrey Chepalyga (Russia)—and included 15 ORAL presentations with two key-note talks given by Tamara Yanina and others (Russia) and Nikolay V. Esin and others (Russia, Ukraine, Canada). The presentations covered a range of topics on the processes of formation within the “CORRIDORS” and the Paratethys Sea-Lake degradation, origin and taxonomy of the Quaternary Ponto-Caspian foraminifera and mollusks, morphodynamics of loess watersheds, changes of landscape and migration of humans, correlation of marine and continental deposits, ecostratigraphy, etc. Panel 3 was titled “TECTONICS”—moderator: Nikolai Esin (Russia) and Hayrettin Koral (Turkey)—and included three presentations on the neotectonics of Anatolia in the crossroads of an evolving orogen (key-note), vertical movements of the coast and shelf of the Black and Mediterranean seas and their impact on coastal processes, and seismic-geotechnical hazard zonation. Panel 4 was titled “MODELING”—moderators: Nikolay Esin and Alexander Kislov (Russia)—and included two presentations devoted to modeling of climate and marine ecosystems. Panel 5 was titled “ARCHAEOLOGY, HISTORY, AND ETHNOLOGY”—moderators: Andrey Chepalyga (Russia) and Olena Smyntyna (Ukraine)—and included six presentations with a key-note talk by A. Chepalyga (Russia). The presentations were devoted to new data on the North Black Sea corridor of the first European migrations focused on the discovery of multilayered Oldowan sites in Crimea (key-note); reconstruction of the archaeological landscape of the western shore of the Caspian Sea at the end of the upper Pleistocene-Early Holocene; paleoanthropology of the Yamna-culture populations in the Kumo-Manych depression: craniological specificity of the Yamna culture people from the Lower Volga region; paleoanthropology of fossil hominins from the Levant and Iraq; and response of humans to global climate change in the NW Black Sea region at the Pleistocene-Holocene boundary.

The POSTER session included 34 poster presentations with wide range of subjects on geophysics, morphotectonics, structure and genesis of islands, remote sensing, transgressive-regressive sea-level changes and coastline migration, economy of Late Mesolithic–Early Neolithic communities with respect to climate changes, marine habitats, lithostratigraphy,

paleogeography, palynology (diatoms, pollen, NPP), deepwater peloids, modern fauna of the anoxic zone as a remnant of the ancient anoxic biosphere, mud volcanoes, underground freshwater sources, micro-(foraminifera) and macrozoobenthic communities, environmental stress caused by the Danube discharge into the Black Sea, and the first evidence of Lower Paleolithic open-air sites in Eastern Georgia.

The Technical Sessions were followed by the Round Table that enabled participants to discuss the progress of IGCP 610 and to plan future strategy in running the project. One of the key problems that participants discussed was organizing the Fourth Plenary Meeting and Field Trip in 2016. According to our working plan, it should have been held in Crimea. But due to the geopolitical problems (no need to discuss it here), this was impossible to organize. The Fourth Plenary Meeting and Field Trip was ultimately organized in Eastern Georgia with the main goal of studying the pre-Pleistocene and Pleistocene geological history of the Eastern Paratethys remnants. This subject is very important in shedding light and achieving a better understanding of a possible mechanism of separation of the Eastern Paratethys into the individual seas leading to formation of the Black and Caspian Seas.

The five days of field trips (by bus) were led by prominent Russian geologists and archaeologists and were focused on the archaeological sites “Selitrennoe Gorodische,” Gorodishche Samosdelka, and Pleistocene stratotypes and important outcrops Cherniy Yar, Nizhnee Zaimische, Tsagan-Aman, Lenino, Seroglazovka as well as the Baer Knolls and Volga Delta (Fig. 6; Yanina et al., 2015).

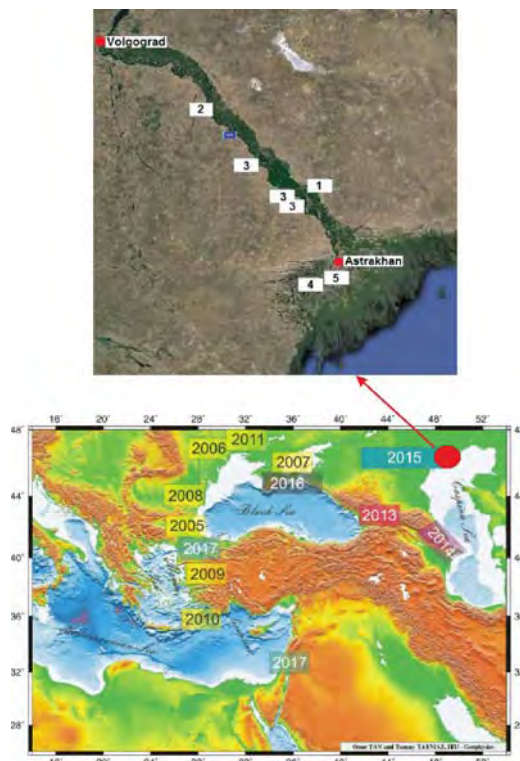


Figure 6. The Caspian-Black Sea-Mediterranean “CORRIDORS” (lower): in yellow are the locations of IGCP 521-INQUA 501 meeting and field trip sites (2005-2011); in other colors are sites to be studied by the present IGCP 601 Project: 2013 – Tbilisi, Georgia; 2014 – Baku, Azerbaijan; 2015 – Astrakhan (Lower Volga), Russia (marked in red circle); 2016 – Sevastopol (Crimea) and the Taman Peninsula, Russia; 2017 – Haifa, Israel, and Istanbul, Turkey. (upper): Map of the Lower Volga region with geological and archaeological sites visited during the Field Trips on September 25 (1), 26 (2), 27 (3), 28 (4), 29 (5) 2015.

Field trips were focused on the spectrum of Quaternary geological sequences exposed within sections of the Lower Volga area. This includes major exposures in the Volga valley between Astrakhan and Volgograd: Cherniy Yar – Nizhnee Zaimische, Kopanovka, Lenino, and Seroglazka. The conference participants were able to see deposits of the Baku, Early Khazarian, Late Khazarian, Khvalynian, and Novocaspian transgressions, and the continental sediments separating them: Singilsky, Chernoiarsky, and Atel. Participants were able to select samples for faunal, palynological, and other tests. They also observed the Baer knolls (named for Karl Baer, who described them for the first time in the 19th century), which are east-west elongated ridges in the Caspian Lowland, a unique natural formation that has no analogues in the world.

Archaeological tours were held at the main ancient sites of the region. The first is the archaeological complex "Selitrennoe gorodishche" (Saltpeter Settlement), which is located 130 km north of Astrakhan. In the XIII to XIV centuries, it was the capital of the richest nomadic state in the Middle Ages, Sarai-Batu, seat of the Golden Horde founded by Genghis Khan's grandson, Batu Khan. A natural outcrop of the Caspian Pleistocene sediments is situated on the Akhtuba coastal cliff near the archaeological complex, so it was also available for a visit. Another archaeological site of the region—Gorodishche Samosdelka (the Ancient Itil Settlement)—is located 45 km below Astrakhan on the right bank of the Old Volga River. The main part of the settlement is situated on an island, surrounded by dried up canals. Cultural layers of this medieval city, with a total depth of about 3–3.5 m, contain the artifacts of the Khazar Khaganate Culture, the golden age of the city Saksin (XI to XIII centuries) which predated Sarai Batu. There also is located the famous Museum of Russian Watermelon. September is the best time for this delicious fruit. Plans were made to visit other archaeological and historical places in Astrakhan: the Astrakhan Kremlin, which was built between 580 and 1620, and the Regional Natural History Museum, which covers the history of the natural environment of the region and displays many of the paleontological finds from the Pleistocene deposits of the Volga valley, together with historical and archaeological objects.

### **3. Workshops and Summer Schools**

- Workshop in Sozopol (Bulgaria, September 2013)
- Workshop in Kirklareli (Turkey, September 2014)
- Workshop in Ahtopol (Bulgaria, December 2014)
- Workshop "Late Pleistocene of the Caspian Sea: Paleogeography, Correlation with Events in the Black Sea Region and Russian Plain" (Moscow, Russia, April 2015)
- Workshop "Caspian Sea Level Change from the from the Point of View of Geomorphology" (Moscow, Russia, November 2015)
- Summer School in Kalmykia (May 2014)
- Summer School in the Danube Delta on-board the floating laboratory boat "Halmyris" (Romania, summer 2013, 2014, 2015)

### **4. Field studies (2013-2015)**

The field studies were performed in the:

- Kalmykia region, where transgressive geological sections of Khazarian and Khvalynian age were studied.



- Lower Volga region, where the Srednyaya Akhtuba (Middle Akhtuba) geological section was investigated. This section is located within Volgograd county and includes Khvalynian and Atelian sediments as well as three horizons of buried soils of Khazarian age.
- Eastern part of Manych, where relics of different stages of the Early Khvalynian transgression were investigated.
- Turkmenistan, where Cheleken geological sections have been studied and samples from the Bakinian, Urundzhikian, Khazarian, and Khvalynian strata were collected.
- Kerch Strait coast, where Holocene geological sequences were investigated.
- Iznik Lake (Turkey), where Middle Pleistocene geological sequences were studied.
- Moldova, Crimea, Taman peninsula, Eastern Thrace, Bosphorus coast and Aşağı Pinar, and the Danube delta, where particular attention was paid to geoarchaeological evidence.
- The fieldwork projects permitted collection of several hundred samples that were treated in different laboratories by various techniques. In particular, the first optical-luminescent dates of all strata in geological sections were obtained.

#### **5. IGCP 610 special sessions at the international fora:**

- 2013: “Under the Sea: Archaeology and Palaeolandscapes” (Szczecin, Poland, September 2013)
- 2014: “Recent Problems on Lithology of Sedimentary Basins of Ukraine and Adjacent Territories” (Kiev, Ukraine, October 2014)
- 2014: “Geography and Geology in Secondary Education: the Modern State and Problems” (Odessa, Ukraine, October 2014)
- 2015: XXI International School on Marine Geology (Moscow, November 2015)
- 2015: All-Russian Conference "VII Shchukin readings" (Moscow, May 2015)
- 2015: All-Russian Conference “Actual Problems of Paleogeography and Stratigraphy of the Pleistocene” with international participation (Moscow, Russia, June 2015)
- 2015: “IGCP 610 Quaternary stratigraphy of the Ponto-Caspian region” at the 2nd International Congress on Stratigraphy - STRATI 2015 (Graz, Austria, July 2015)
- 2015: IGU Regional Conference 2015 "Geography, Culture and Society for Our Future Earth" (Moscow, Russia, August 2015)
- 2015: IGCP 610 Session #37125 “From the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary (IGCP 610)” at the GSA Annual Assembly (Baltimore, USA, November 2015)

#### **6. IGCP 610 Special Volumes:**

- 2013: Peer-Reviewed Conference Proceedings of IGCP 610 First Plenary Conference.
- 2013: Field Trip Guide of IGCP 610 First Plenary Conference
- 2014: Peer-Reviewed Special Volume of the international scientific journal *Stratigraphy and Sedimentology of Oil-Gas Basins*
- Conference Proceedings of IGCP 610 Second Plenary Conference.

- 2014: Field Trip Guide of IGCP 610 Second Plenary Conference.
- 2015: Peer-Reviewed Special Volume of the journal *Quaternary International* devoted to IGCP 510 studies
- 2015: Peer-Reviewed Conference Proceedings of IGCP 610 Third Plenary Conference
- 2015: Field Trip Guide of IGCP 610 Third Plenary Conference

## **7. Linkage with other projects and organizations**

- EU-ITN programme "Drivers of Pontocaspian biodiversity rise and demise" (2015-2019)
- EU-WAPCOAST BS-ERA.NET 076 "Water Pollution Prevention Options for Coastal Zones and Tourist Areas: Application to the Danube Delta Front Area"
- ICOMOS The International Council on Monuments and Sites
- COCONET "Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential," supported by EU
- ECOST-MEETING-TD0902-090310-001280 SPLASHCOS "Submerged Prehistoric Archaeology and Landscapes of the Continental Shelf"
- Project № 539 "Study of the formation processes and spatial distribution of methane in the Black Sea and theoretical considerations of their influence on basin eco- and geosystems," supported by the Ministry of Education and Science of Ukraine (2015-2017)
- Project № 557 "Theoretically justify interaction between nature and human society in the northwestern Black Sea during the late Pleistocene and Holocene" supported by the Ministry of Education and Science of Ukraine (2016-2018)
- Project № 11-05-00093 "Caspian region: Peculiarities of development of the environment under climate and sea level change," supported by the Russian Foundation for Fundamental Research (2011-2013)
- Project № 12-05-01052 "Evolution of the relief of the Azov and Black Sea coast, climate, and sea level change: Comparative analysis and chronology of environmental processes for the last 20 ka," supported by the Russian Foundation for Fundamental Research (2012-2014)
- Project № 13-05-00086 "Pont-Manych-Caspian oceanographic system in the late Pleistocene: Systematics and correlation of events, evaluation of character and degree of interaction, paleogeographic consequences in the region," supported by the Russian Foundation for Fundamental Research (2013-2015)
- Project № 13-05-00242 "Radioisotope stratification of age and synchronization of the Quaternary deposits of the Ponto-Caspian," supported by the Russian Foundation for Fundamental Research (2013-2015)
- Project № 13-05-00625 "Peculiarities of the evolution of relief in the Northern Caspian region in the late Pleistocene: Main stages of the development, chronology, and correlation with climatic rhythms in the Black Sea-Caspian region," supported by the Russian Foundation for Fundamental Research (2013-2015)

- Project № 12-05-31281 “Khvalynian epoch in the history of the Caspian region: Paleoclimates and environmental evolution,” supported by the Russian Foundation for Fundamental Research (2012-2014)
- Project № 14-04-00227 "Environmental evolution of the Caspian and Black Sea under the climate changes," supported by the Russian Foundation for Fundamental Research (2014-2016)

## **8. Scientific results**

- Establishing the Reference List of main publications on Project subjects; a majority of which are published in Russian and their titles required transliteration and translation into English
- Collecting the data set on chronometric data
- Correlating the Regional Stratigraphic Scales
- Establishing a reference collection on Ponto-Caspian foraminifera (supplemented by SEM images) and mollusks
- Collecting a series of regional paleogeographic and geological maps
- Continuing the development of a common geochronological frame necessary for correlating major events in human prehistory and history with global environmental changes
- Collaborative Danube Delta studies of samples from delta front to the outer shelf enabling the quantification of differences among palynology processing methods and revealing a new paradigm for palynomorph distribution models in microtidal semi-enclosed basins
- Collaborative Danube Delta studies from delta front to the outer shelf on soft and hard-shelled meiobenthos (nematodes, polychaetes, foraminifera, ostracoda, etc.) and mollusks
- Developing a model for the filling of the Black Sea basin by Mediterranean salt water during the Holocene
- Developing a model for the processes of Caspian-Mediterranean corridor formation and Paratethys Sea-Lake degradation
- Observations of geological characteristics of Quaternary stratotypes as well as key archaeological and paleontological sites in Georgia, Azerbaijan, and Russia with further investigations of samples in various laboratories around the world
- The study of archaeological sites including Gobustan with its famous petroglyphs of the Mesolithic age. Plans included visits to some archaeological and historical places in Baku: the Shirvanshakh Palace constructed during the period from the XIIIth to the XVIth century; the Maiden Tower (the most mysterious monument of Baku) of which the unique construction has no analogues in the East
- Detailed study of chocolate clays in the Middle and Lower Volga region that have enabled the discovery of a direct correlation between their occurrence and morphology of relief. Material collected by the expedition is currently being studied using palynologic, lithologic, geochronologic, malacofaunal, and micropaleontologic methods

- Developing of a Holocene stratigraphic scale for the Iranian coast of the Caspian Sea
- Obtaining new material for paleogeographic reconstructions of the Caspian basin from biostratigraphic analysis of five boreholes recovered in the North Caspian. Two marine strata that are absent on the coasts were discovered. Also, obtained a series of new radiocarbon dates for sediments and events of the late Pleistocene in the Caspian.

### **9. Disseminating the project events and activities**

Via regular updating of Project websites and mailing list of the project contributors, which increased from 957 in 2013 to 1039 in 2014 and 1310 in 2015, as well as social networks (Facebook for English and non-English-speakers, and Вконтакте for mostly Russian speakers):

<https://www.facebook.com/groups/180481035443572/>,  
[http://vk.com/album115218532\\_181815723](http://vk.com/album115218532_181815723)

### **10. Social benefits**

Implementing cultural heritage projects, open-air site museums, training centers in schools with the possibility of conducting experimental research, working together with local Governmental and Non-Governmental Organizations across the Caspian-Black Sea-Mediterranean Corridors that we study as a single geographic unit, bypassing linguistic and political boundaries, and thus encouraging East-West dialogue, cooperation, and integration of researchers from different countries into the international R&D community; enhancing our understanding of the links between environmental change and human adaptation, contributing to an improvement in human living conditions (especially for those at risk from coastal flooding), and promoting the wise use of the Earth as a human habitat; and preserving human heritage by addressing and clarifying existing archaeological, ethnological, and paleoanthropological questions concerning the evolution of human subsistence strategies, social and ideological spheres in the light of environmental change, and human physical and cultural adaptation theory.

### **11. Educational, training or capacity building activities**

Enabled participants to visit relevant sites in the Caspian region of the CORRIDORS under the guidance of local experts with on-site discussion of scientific issues; formed a platform for young undergraduate and postgraduate students to benefit from international exposure and interaction with scientists from different parts of the world and varied specialties in order to cultivate traditions of “European style” scientific fora as well as scientific discussion and informal meetings. This also promoted their interest in particular specialties and motivated them to learn foreign languages in order to improve communication skills with western colleagues.

Promoted a multidisciplinary approach in paleoenvironmental studies, which has encouraged students in geology to take archaeological courses and *vice versa*. This has stimulated teachers to modify their curricula for undergraduate and graduate students; promoted the preparation of several MA and PhD theses on subjects within the IGCP 610 project.

Encouraged the establishment of direct contacts between western and eastern youth, creating the background for better understanding of modern priorities in the developing world of science and humanities.

Exposed the younger generation in developing countries to new analytical techniques and state-of-the-art data interpretation in the field of sustainable development and environmental risk protection, as well as human cultural development; informed the wider public about the evolution of the environment during the Quaternary.

## 12. Activities planned

### *Efforts are ongoing:*

- To maximize IGCP 610 exposure via diffusion of results in key international journals and updates of our web pages to ensure wide accessibility and increased interactive potential for project participants, the scientific community at large, relevant agencies, and the public
- To consolidate scientific achievements as a basis for developing future strategies
- To continue to augment the funding base with upcoming and submitted research proposals through various funding agencies
- To publish the next special volume of *Quaternary International* devoted to the achievements of IGCP 610

### *Meetings and field trips planned (and completed) include:*

- The Fourth Plenary Meeting and Field Trip, Tbilisi, Georgia, (2-9 October 2016)
- Special Session SSP4.5 “From the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary (IGCP 610)” and “ERE1.5 Methane in marine ecosystems: Significance for geological exploration, ecology and navigation” to be held in the framework of the European Geosciences Union General Assembly in Vienna, Austria, 17–22 April 2016
- Symposium “From the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary (IGCP 610)” to be held at the 35 International Congress, 27.08-4.09.2016, Cape Town, South Africa
- Winter-2016 youth School-Expedition to the Manych valley

### *Field and sea work*

- Middle Volga
- Coastal zone of the Sea of Azov
- Drilling of the borehole with 30 m deep in the delta of the Don River
- Complex investigation of Middle Akhtuba geological section
- Complex investigation of geological sequences on the Taman peninsula
- Large-scale complex expedition – Youth School in the Lower Volga area
- Expedition to the northwestern Black Sea

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