



Editorial

INQUA focus group SACCOM: 1709 “Ponto-Caspian stratigraphy and geochronology (POCAS)”



This first Special Volume of *Quaternary International* of the INQUA FG 1709 POCAS and IGCP 610 contains ten selected papers presented at the First and Second Plenary Meetings of the INQUA Focus Group SACCOM: 1709 “Ponto-Caspian Stratigraphy and Geochronology (POCAS)” [INQUA POCAS] (Yanko-Hombach et al., 2018) that were carried out jointly with the Fifth and Sixth Plenary Conference and Field Trips of IGCP 610 project “From the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary” (Yanko-Hombach, Yanina, 2019) in Palermo (Italy), and Antalya (Turkey) in 2017 and 2018, respectively (Fig. 1).

The Conferences Programs, Proceedings and the Field Trip Guides can be obtained from http://www.avalon-institute.org/inqua/meeting_past.php.

The INQUA POCAS project was created to study the Quaternary geology of the Ponto-Caspian region as a single geographic entity, bypassing linguistic/political/disciplinary boundaries, linking continents (Europe and Asia) more closely, and encouraging East-West dialogue and cooperation among researchers. The Ponto-Caspian is defined as a chain of intercontinental basins that encompasses the Caspian, Black, Azov seas, the Kerch Strait, the Manych Valley, and their coasts. This chain represents a unique oceanographic system of relict Paratethys basins, which were repeatedly connected and isolated from each other during the Quaternary. Due to its geographical location and semi-isolation from the open ocean, this region acts as a paleoenvironmental amplifier and a sensitive recorder of climatic events, in particular glacial-interglacial cycles on the Eastern European Plain and mountains, as well as transgressive-regressive sea-level variations. Thus, it can be considered as a type region where geological history is well recorded in a long series of marine and continental sediments that can be used in the development of Pleistocene stratigraphy and geochronology of Central Eurasia. The geological record of the Ponto-Caspian region's history reveals the development of global climatic changes, glacial-interglacial rhythms within the East European plain and mountain areas of the Caucasus and Central Asia, and the history of connection with the World Ocean. The Ponto-Caspian is therefore a type region that could provide a stratigraphic and paleogeographic scheme for Pleistocene events in Central Eurasia. The main activities of INQUA POCAS were oriented toward solving the existing contradictions and conducting new fieldwork by involving a wide range of multidisciplinary scientists and modern research methods and equipment. One of the major goals will be the involvement of ESR to participate in the research and integration of available and newly obtained data. It is of great importance to do this because, so far, there are few specialists (particularly in the developing countries) trained in modern methods and techniques (e.g., isotopic analysis, geochemistry, paleontology, and different types of dating).

The IGCP 610-INQUA POCAS community includes about 260 scientists from 21 countries: Azerbaijan, Belgium, Bulgaria, Canada,

Georgia, Germany, Greece, France, Israel, Italy, Kazakhstan, Latvia, Romania, Russia, The Netherlands, Switzerland, Turkey, Turkmenistan, UK, Ukraine, and USA.

The main activities of INQUA POCAS in 2017 and 2018 were focused in three main directions: I. Carrying out the First and Second Plenary Conferences and Field Trips in Palermo, Italy, and Antalya, Turkey (jointly with IGCP 610); II. Conducting field research in various areas of the Ponto-Caspian; III. Developing the INQUA IFG 1709 POCAS website.

The INQUA POCAS project complements the INQUA SACCOM, CMP, and TERPRO Commissions with which IGCP 521, 610 and INQUA 0501 cooperated previously. It also collaborates with geological surveys, archaeological expeditions, and corresponding museums in all countries bordering the “CORRIDOR.”

The Project is linked to the projects “Uncovering the Mediterranean salt giant (MEDSALT)” COST Action CA15103; No. 557 “Theoretical justification of the 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; RSF 16-17-10103 “The Caspian Sea System in the Conditions of Global Quaternary Climate Change”; RSFBR 19-05-01004 “Chronology of paleogeographic events of the late Pleistocene of the Dagestan coast of the Caspian Sea”; 18-05-00296 “Kerch Strait in Global Climate Change (Late Pleistocene-Holocene)”; 19-77-10077 “Chronology of paleogeographic events of the South-East Plain in the Pleistocene and Holocene: new approaches and methods.”

Dissemination of project events and activities occurred via regular updating of project websites <http://www.avalon-institute.org/inqua/> and the mailing list of project contributors, which increased from 957 in 2013 to 1254 in 2019, as well as social networks (Facebook for English and non-English-speakers, and Вконтакте (VKontakte) for mostly Russian speakers) <https://www.facebook.com/groups/180481035443572/>, http://vk.com/album115218532_181815723.

The First Plenary Conference and Field Trip of INQUA POCAS was organized jointly with IGCP 610. This event was hosted by the University of Palermo, Italy. The Meeting and Field Trip were held in Palermo and Agrigento, respectively. The Field Trip focused on the GSSPs of the Zanclean, Piacenziano, Gelasian, and Calabrian stages of the Plio-Pleistocene in the Mediterranean as well as on a number of archaeological sites (Fig. 2). The Joint Plenary Conference and Field Trip of the two projects made the following possible for the participants: (1) To discuss the actual status of both projects and progress made by participants. Particular attention was paid to scientific approaches for integrating environmental, anthropological, ethnological, and archaeological data in order to trace the history of ancient humans from the Caspian to the Mediterranean during the entire duration of the Quaternary; (2) To introduce young scientists, especially from the

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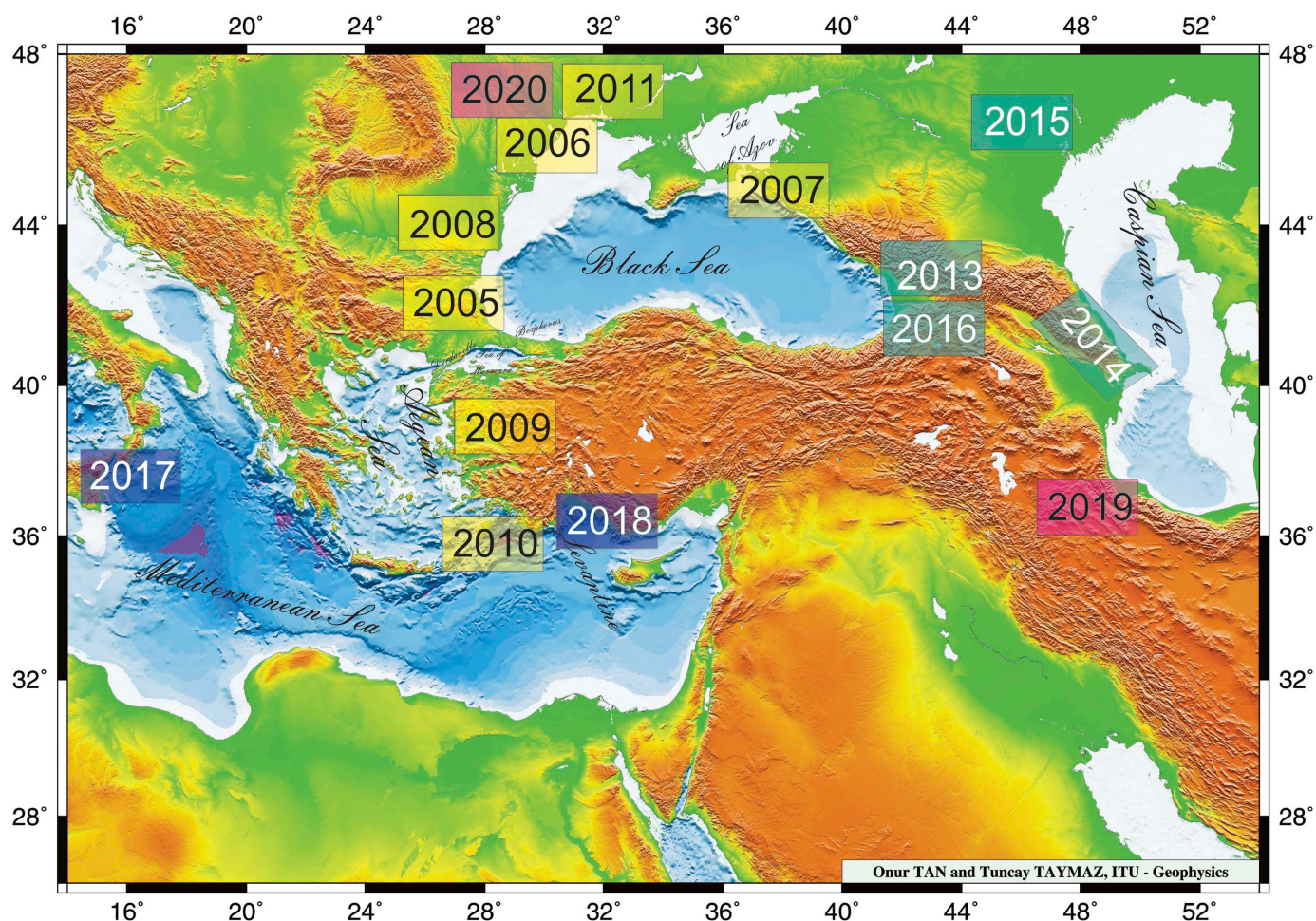


Fig. 1. The Caspian-Black Sea-Mediterranean “CORRIDOR”: in yellow are the locations of IGCP 521-INQUA 501 meeting and field trip sites (2005–2011); in green are sites studied by IGCP 610: 2013 – Tbilisi, Western Georgia, 2014 – Baku, Azerbaijan, 2015 – Astrakhan’ (Volga delta), Russia, 2016 – Tbilisi (Eastern Georgia); in dark blue jointly with INQUA POCAS project in 2017 – Palermo, Italy, and 2018 – Antalya, Turkey; in magenta 2019 – Tehran, Iran, 2020 – Odessa, Ukraine, and Tiraspol, Moldova.

Eastern countries, to new analytical techniques and state-of-the-art interpretation of data; (3) To encourage east-west dialogue and integrate researchers from different countries into the international R&D community, as well as contribute to the preservation of cultural and religious heritage through the discussion of ancient cultures, civilizations, and their legends. The 239-page Proceedings (Gilbert, Yanko-Hombach, 2017) of the joint conference contain contributions from 109 scientists from two continents and 14 countries; 61% of the contributors were from developing countries (Fig. 3). About 50% of participants are female. The conference was characterized by a high number of young scientists and students.

The two days of Technical Sessions were organized into four panels with 24 Oral presentations.

Panel 1: GENERAL QUESTIONS OF THE CORRIDOR – moderators: Nikolay ESIN (Russia) and Alexander KISLOV (Russia) – included three ORAL presentations with a keynote talk “Brief history of the astronomical tuning of the Plio/Pleistocene GSSPs outcropping in Sicily (Southern Italy)” given by Prof. A. Caruso. Two other presentations covered possible social-climatic consequences of circulation changeability in Hadley’s cell; and global geological processes in the Caspian-Mediterranean region during the Miocene-Pleistocene; given by Italian, Ukrainian, Russian, and Canadian scientists.

Panel 2: BLACK SEA & SEA OF MARMARA REGION – moderators: Valentina YANKO-HOMBACH (Ukraine, Canada) and Hayrettin KORAL (Turkey) – included 15 ORAL presentations that covered a range of topics on the unique marine terrace system of the Crimean and Black

Sea Basins: stratigraphy, archaeology, and the oldest Oldowan migrations to Europe (keynote); wave climate variation in the Black Sea; microforaminiferal linings as a proxy for paleodelta and paleosalinity analysis; palynomorphs in surface sediments of the Ukrainian part of the northwestern Black Sea shelf; marine geohazards in the Black Sea and their monitoring; OSL-chronology of the late Quaternary loess-soil series in the eastern Azov Sea region; regional distribution and clay mineralogy of modern sediments in the northwestern zone of the Black Sea; Late Miocene volcanic ash layers of the intermountain depression of the Eastern Caucasus: the products of the Megacaldera explosion; late glacial to Holocene Black Sea evolution based on microfaunal and stable oxygen isotope records; neotectonics in the Marmara Region; NW Turkey, narrow shelf canyons vs. wide shelf canyons in the Black Sea; vegetation changes and climate from pollen of the Late Pliocene to Early Pleistocene in the North Caucasus; mud volcanism of the Black Sea region; meiobenthos as an indicator of gaseous hydrocarbon reservoirs under the floor of the Black Sea; and Stone Age people in Crimea: an anthropological study; given by Georgian, Turkish, Russian, Romanian, Ukrainian, Canadian, Chinese, and American scientists.

Panel 3: CASPIAN SEA REGION – moderators: Tamara YANINA (Russia) and Elmira ALIYEVA (Azerbaijan) – included four ORAL presentations that covered a range of topics on the tectonics, fluid dynamics, and Caspian Sea level change: geological and environmental aspects (keynote), bionomy of the southern Caspian basin in the Pliocene-Pleistocene; the Northern Caspian Sea: Environmental consequences of climate change during the Khvalynian epoch (evidence

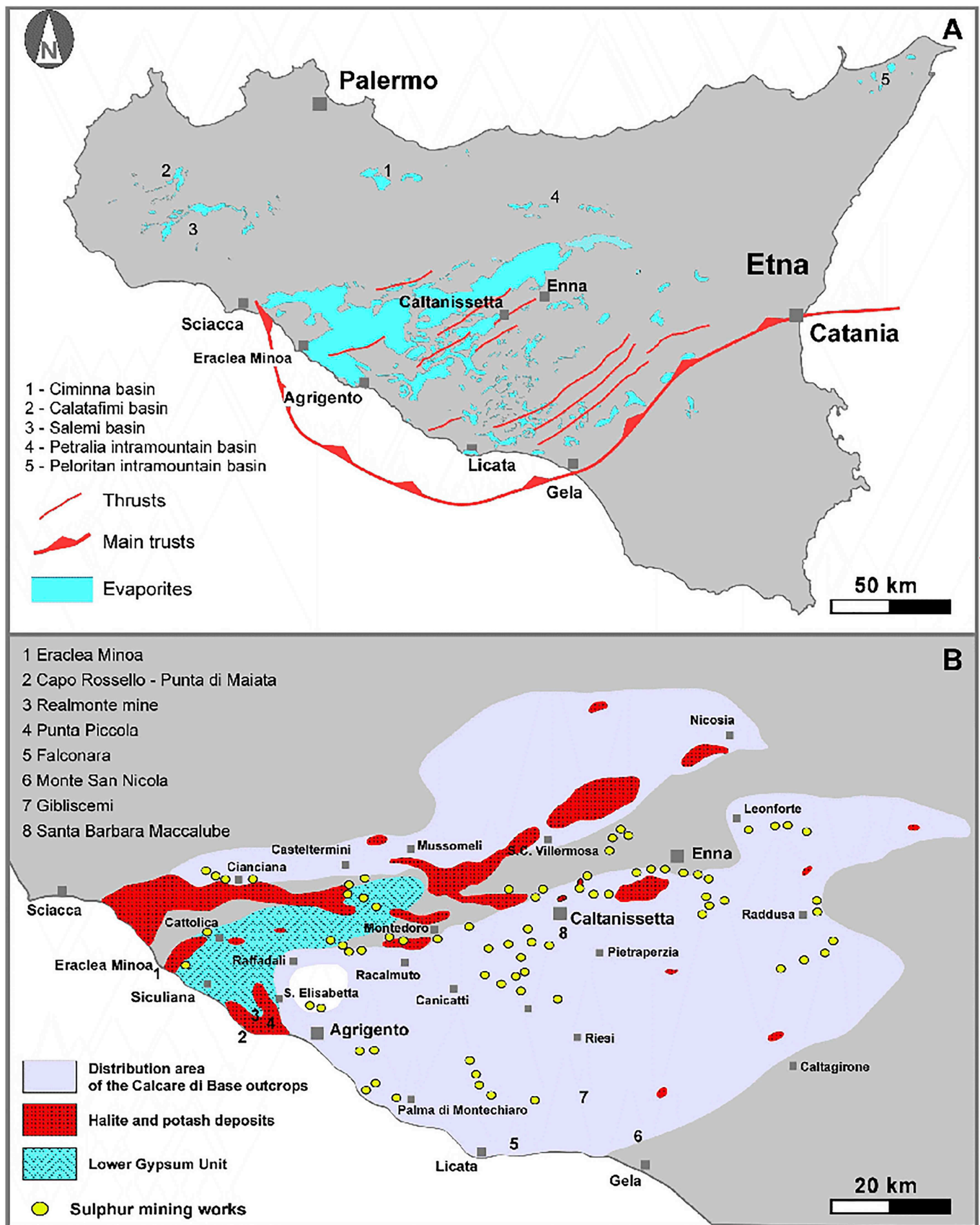


Fig. 2. Simplified location maps of the extent of the Messinian evaporitic sediments where the field trips were carried out. A. Extent of the outcrops of Messinian evaporites in the different Sicilian basins with indication of the major structural features. B. Distribution of the “Calcare di base outcrops” and major evaporitic units (Lower Gypsum and Halite units) with indication of most of the sulphur mines and location of the studied sections (from Caruso et al., 2017).

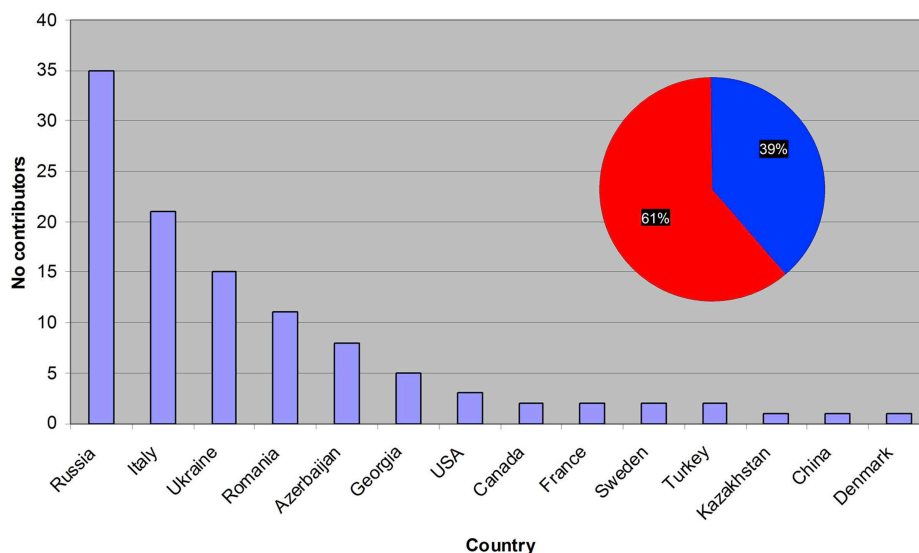


Fig. 3. Number of countries and contributors to the First Plenary Conference and Field Trip of POCAS and IGCP 610 in Italy. The circle shows the percentage of scientists from developing (red) and developed (blue) countries, respectively.

from the boreholes); new results on the chronology of late Pleistocene paleogeographical events of the Northern Caspian Sea (OSL dating); and age of the Paleolithic site Sukhaya Mechetka (Lower Volga region); given by Azerbaijani, Russian, and Turkmenian scientists.

PANEL 4: MEDITERRANEAN REGION – moderators: Antonio CARUSO (Italy) and Svetlana BORUTSKAYA (Russia) – included four ORAL presentations that covered a range of topics on the climate record of Marine Isotope Stage 19 from marine and terrestrial signals in the Alboran and Ionian basins; anthropological characteristics of the adaptation of the Fayoum oasis population (Egypt) in the Greco-Roman period; planktonic foraminifera as proxies of Holocene climatic variability (Tyrrhenian, Mediterranean Sea); and paleoclimatic reconstruction from marine records of the central and western Mediterranean area over last five millennia using planktonic foraminifera; given by Italian and Russian scientists.

The POSTER session included 29 presentations. Each presenter obtained 5 min to present his or her poster orally. Poster sessions covered a wide range of subjects on the circumstances of paleogeographic formation of the Productive Series basin of eastern Azerbaijan and on the first Pliocene sea-level fluctuation; magnetometric and electrometric investigations in the Salsovia submerged archaeological site; the role of coastal geomorphology in interpreting the history of the northern Caspian plain in the late Pleistocene; methods and equipment for conducting field research into surface layer characteristics by sounding in the short-wave range of radio waves in order to study environmental change; the first experience of dendroclimatological research in the eastern part of the Kazakh Upland (Saryarqa); the main stages of vegetation and climate evolution in the Kuban River Delta Region during the last 7.4 ka and their correlation with sea-level fluctuations of the Black Sea; the role of the Black Sea shelf techno-geological system in the integrated management of rational resource use; monitoring of climate oscillations in the Mediterranean Sea over the last two millennia using planktonic foraminifera; dynamics of the Black Sea coast and vertical movements of the shelf in the late Pleistocene-Holocene; integrating high resolution Mid-Pleistocene sea surface temperature and productivity estimates from alkenone proxies with marine and terrestrial climate signals; first discoveries of Oligocene diatomic flora in the section of Pirakashkul (Shamakhi-Gobustan zone); paleoenvironmental reconstructions at the Pleistocene-Holocene boundary in the Black Sea based upon benthic foraminifera; geoacoustic and gas geochemical signs of hydrate presence on the continental slope of the northeastern Black Sea; chemical composition of Lower Khvalynian

deposits in the Middle and Lower Volga region; small mammal faunas from the Mikulino (=Eemian) marine and liman deposits of the Black Sea; vortices of the Cretan straits of the eastern Mediterranean and the Black Sea shelf; evaluation of geological hazards for the Trans-Caucasus Caspian oil and gas pipelines in the Abul-Samsari volcanic ridge section; hydrogeochemical evolution of limans of the northwestern Black Sea region in connection with the problem of their use as salt sources; sedimentary structure and late Holocene evolution of the coastal embayment on the southeastern coastline of the Crimean peninsula (Black Sea); unknown morphotypes as permanent representatives in the Black Sea anoxic and sulfidic bottom sediments; petrographic description of Chokrak-Spirialis Miocene deposits of Eastern Azerbaijan; Holocene environments of the Volga River Delta: inferred from diatom assemblages in sediments of the Rycha River Channel; correlation of the Late Quaternary sediments of the Eastern Mediterranean and Ponto-Caspian basins; adjustment theory in the study of human responses to global climate change in the northwestern Black Sea region at the Pleistocene-Holocene boundary; paleogeographic stages of development of the Iranian coast of the Caspian Sea in the Holocene; biodiversity of the Volga River delta mollusks in the Holocene; paleogeography of the Atelian period in the lower Volga region; Apsheron deposits (Late Early Pleistocene) of the Lower Volga (Astrakhan Arch); given by Romanian, Turkish, Canadian, Ukrainian, Turkmenian, Russian, and American scientists.

The Technical and Poster Sessions were followed by the Round Table that enabled participants to discuss the progress of both projects and to plan future strategy in running them. It was decided to summarize Project activities in a series of selected papers in the next IGCP 610 special volume of Quaternary International, a paper in Epizodes (Yanko-Hobach, Yanina, 2019), and organizing the IGCP 610-INQUA POCAS Second Joint Plenary Conference and Field Trip in Antalya, Turkey, planned for September 30-October 7, 2018.

The Second Plenary Conference and Field Trip of INQUA POCAS was organized jointly with IGCP 610. This event was hosted by the University-Cerrahpaşa, Department of Geology, Faculty of Engineering, Turkey, October 14–22, 2018. It was focused on the late Miocene-Plio/Pleistocene geological history of the eastern Mediterranean of southern Turkey along the central Taurid Mountains. This subject is very important in shedding light and achieving a better understanding of tectonic-climatic interactions during the Plio/Quaternary period in this region. The Field Trips were designed to observe geological characteristics of Quaternary and Pliocene stratotypes as well as key



Fig. 4. Locations of the field trips in Antalya, Turkey, in 2018.

archaeological and paleontological sites (Fig. 4). All of them are easily accessible for further study and cooperative investigations in various laboratories around the world. The two days of Technical Sessions were organized into four panels with 24 Oral presentations.

The 218-page Proceedings (Gilbert and Yanko-Hombach, 2018 of the joint conference contain contributions from 109 scientists from two continents and 14 countries; 61% of the contributors were from developing countries. About 50% of participants were female. The conference was characterized by high number of young scientists and students (Fig. 5).

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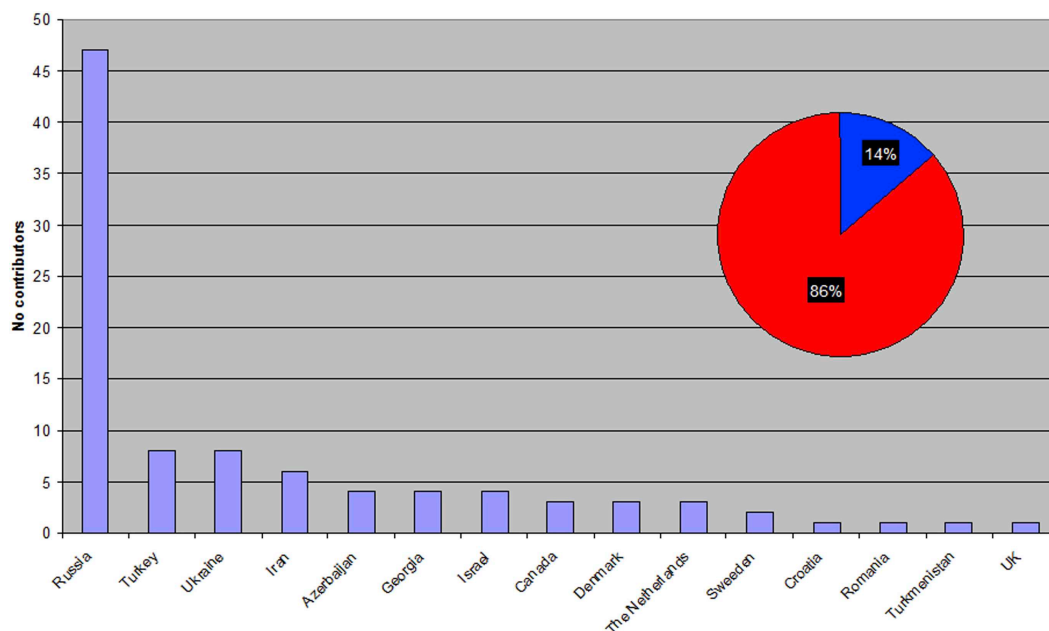


Fig. 5. Number of countries and contributors to the Second Plenary Conference and Field Trip of the INQUA POCAS and IGCP 610 in Turkey. The circle shows the percentage of scientists from developing (red) and developed (blue) countries, respectively.

geochemical signs of hydrate presence on the continental slope of the northeastern Black Sea; chemical composition of Lower Khvalynian deposits in the Middle and Lower Volga region; small mammal faunas from the Mikulino (=Eemian) marine and liman deposits of the Black Sea; vortices of the Cretan straits of the eastern Mediterranean and the Black Sea shelf; evaluation of geological hazards for the Trans-Caucasus Caspian oil and gas pipelines in the Abul-Samsari volcanic ridge section; hydrogeochemical evolution of limans of the northwestern Black Sea region in connection with the problem of their use as salt sources; sedimentary structure and late Holocene evolution of the coastal embayment on the southeastern coastline of the Crimean peninsula (Black Sea); unknown morphotypes as permanent representatives in the Black Sea anoxic and sulfidic bottom sediments; petrographic description of Chokrak-Spirialis Miocene deposits of Eastern Azerbaijan; Holocene environments of the Volga River Delta: inferred from diatom assemblages in sediments of the Rycha River Channel; correlation of the Late Quaternary sediments of the Eastern Mediterranean and Ponto-Caspian basins; adjustment theory in the study of human responses to global climate change in the northwestern Black Sea region at the Pleistocene-Holocene boundary; paleogeographic stages of development of the Iranian coast of the Caspian Sea in the Holocene; biodiversity of the Volga River delta mollusks in the Holocene; paleogeography of the Atelian period in the lower Volga region; Apsheron deposits (Late Early Pleistocene) of the Lower Volga (Astrakhan Arch); given by Romanian, Turkish, Canadian, Ukrainian, Turkmenian, Russian, and American scientists.

The Technical and Poster Sessions were followed by the Round Table that enabled participants to discuss the progress of both projects and to plan future strategy in running them. It was decided to summarize Project activities in a series of selected papers in the next IGCP 610 special volume of Quaternary International, a paper in Epizodes (Yanko-Hobach, Yanina, 2019), and organizing the IGCP 610-INQUA POCAS Second Joint Plenary Conference and Field Trip in Antalya, Turkey, planned for September 30-October 7, 2018.

The five days of field trips (by bus) were led by prominent Turkish geologists and archaeologists in the area shown in Fig. 5. For more information, see the Field Trip Guide and references in it (Caruso et al., 2017).

The two days of Technical Sessions were organized into four panels

with 24 Oral presentations. This Special Volume brings together selected papers on aspects of the data, and discussions reflect efforts at articulating paleoenvironmental history, climate dynamics, sea-level changes and coastline migration, regional hydrological variations, and geomorphology in the “Corridor.”

Panel 1: GENERAL QUESTIONS OF THE CORRIDOR – moderators: Nikolay ESIN (Russia) and Alexander KISLOV (Russia) – included three ORAL presentations with a keynote talk “Caspian - Black Sea - Mediterranean corridor: Water exchange and migrations of fauna during the last climatic macrocycle” given by Prof. Yanina. Two other presentations covered the role of climatic stress in the life of the ancient civilizations of the region of the Fertile Crescent; and the deep seas formation features in the conditions of the Mediterranean Sea desiccation and the negative pressure appearance in the Earth's mantle; given by Ukrainian and Russian scientists, respectively.

Panel 2: BLACK SEA & SEA OF MARMARA REGION – moderators: Valentina YANKO-HOMBACH (Ukraine, Canada) and Hayrettin KORAL (Turkey) – included nine presentations with a keynote talk “Chronostratigraphic correlation of Ponto-Caspian and Mediterranean basins for the reconstruction of water change and the first peopling of Europe” given by Prof. Chepalyga, Russia. Other presentations covered a range of topics on tectonically modified coastal shorelines in the Marmara region, NW Turkey: evidence from the archaeological site; interactions between two different realms in the Marmara gateway: an overview on Quaternary stratigraphy with new findings (NW Turkey); ostracod assemblages on the outer northeastern Black Sea shelf during the last 300 years; reconstructions of the environmental, climatic and cultural changes in the Holocene based on the Yenikapı-Istanbul excavations; submerged archaeological sites from Turkey; paleoanthropological study of the population that inhabited the Taman Peninsula at the end of the Golden Horde period; role of migrations in cultural exploration of the Lower Danube region in Early Prehistory; Quaternary development of southern Levant caves: window to Out of Africa hominin migration; given by scientists from Denmark, Israel, Russia, Sweden, the Netherlands, Turkey, and Ukraine.

Panel 3. CASPIAN SEA REGION – moderators: Tamara YANINA (Russia) and Elmira ALIYEVA (Azerbaijan) – included 13 presentations. The keynote talk “Eastern Paratethys - Mediterranean connections during the Neogene and Quaternary” was given by Prof. Popov

(Russia). Other presentations covered a range of topics on the Ponto-Caspian biostratigraphy, sea level, and salinity reconstructions using benthic foraminifera as the main tool; observations of Caspian strandlines, their use as highstand indicators with consideration for their implications with regard to regional geomorphology, paleodrainage, and biodiversity; timing of mud volcanic activity in the South Caspian and its environmental impact; the prospects of creation of UNESCO geoparks as a geocological tool to preserve the geoheritage of Azerbaijan; opposite marine and coastal environmental consequences of the Caspian rapid sea-level fall; the Baer Knolls of the Caspian Depression as the Late Quaternary aeolian landforms: pros and cons, or only pros? anthropomorphic images in Azerbaijan's landscape and their possible significance; the loess-soil sequences in the Lower Volga area: stratigraphy, geochronology, and paleogeography; first results of stable oxygen isotope analysis of Late Pleistocene sediments in the North Caspian basin; the late Pleistocene Hyrcanian passage in the Manych Depression; grain-size and geochemical characterization of Baer knolls sediments in the Volga delta; Caspian Sea during the Anthropocene; given by scientists from Azerbaijan, Denmark, Iran, Russia, The Netherlands, Sweden, Turkmenistan, and the UK.

The POSTER session included 17 presentations. Each presenter obtained 5 min to present his or her poster orally. Poster sessions covered a wide range of subjects on the circumstances of coastal zone reaction to sea-level fluctuations; development of the delta against the background of the Caspian sea-level fluctuations; changes of climate and environments in the Lower Volga region during the Holocene; problem of palynology of the Early Khvalynian chocolate clays of the Lower Volga region; Quaternary ostracod assemblages of the Apsheron archipelago at the Pleistocene-Holocene boundary on the northwestern shelf of the Black Sea based on micropaleontological data; optically-stimulated luminescence ages of the Early Khvalynian chocolate clays of the Lower Volga; dinoflagellate marker species of the relic Paratethyan seas: Pannonian to Caspian basins; Palynology of Core 38 and its implications for understanding climate and salinity changes of the Late Pleistocene (Neoeuxinian) Black Sea Lake; genetic significance of fluid inclusions in minerals from the outbursts of mud volcanoes of the Azov-Black Sea region; Quaternary volcanos of Shavnabada and Tavkvetili (Georgia): possible hazards for the Azerbaijan-Turkey oil and gas pipelines; paleogeographic reconstruction of Karkinit'skiy Bay (the northwestern Black Sea shelf); use of complex geological, geochemical, and geophysical data for the determination of Upper Miocene transgressions in the West-Kuban depression of the Western Ciscaucasus; sedimentology and the source of sand barriers of Caspian Sea southeast east (Amirabad to Ashuradeh); geomorphological evolution of the plains of Gorgan during the Khvalynian Transgression of the Caspian Sea (Golestan Province of Iran); meiobenthos of abandoned oil-wells in the Northern Caspian Sea; Seroglavovka locality: Quaternary key site of the North Caspian Depression, Russia; presented by scientists from Azerbaijan, Canada, Croatia, Denmark, Georgia, Germany, Iran, Russia, Sweden, The Netherlands, and Ukraine.

The Technical and Poster Sessions were followed by the Round Table that enabled participants to discuss the progress of both projects and to plan future strategy in running them. It was decided to summarize Project activities in a series of selected papers in the next IGCP 610 special volume of Quaternary International, and organizing the IGCP 610-INQUA POCAS Third Joint Plenary Conference and Field Trip in Tehran, Iran, planned for October 11–18, 2019.

Two joint Plenary Conferences and Field Trips in Italy and Turkey made the following possible for the participants: (1) to discuss the actual status of both projects and progress made by participants. Particular attention was paid to scientific approaches for integrating environmental, anthropological, ethnological, and archaeological data in order to trace the history of ancient humans from the Caspian to Mediterranean during the entire duration of the Quaternary; (2) to introduce young scientists, especially from the Eastern countries, to new analytical techniques and state-of-the-art interpretation of data; (3)

encourage east-west dialogue and integrate researchers from different countries into the international R&D community, as well as contribute to the preservation of cultural and religious heritage through the discussion of ancient cultures, civilizations, and their legends.

Overall, the meetings provided an excellent opportunity for international discussion of different methods and interpretations used to analyze the history of a huge geographical area from the Caspian to the Mediterranean during the full duration of the Quaternary. It also emphasized the importance of studying the Pre-Quaternary geological history in order to discover continuity in development. The meeting stimulated an exchange of data and publications, as well as encouraged future collaboration between physical and social scientists across the globe. It brought together multidisciplinary scientists from all over the world, and in the process enhanced West-East scientific dialogue by providing a supportive background for collaboration regarding the correlation and integration of discoveries involving the influence on humans of climatically/tectonically induced sea-level changes and coastline migration. The meeting encouraged the younger generation to engage in the multidisciplinary study of the region using advanced analytical techniques and methodologies for geoarchaeological investigations.

This Special Volume brings together selected papers on aspects of the data, and discussions reflect efforts at articulating paleoenvironmental history, climate dynamics, sea-level changes and coastline migration, regional hydrological variations, and geomorphology in the “Corridor.”

Five papers are devoted to the Northern Caspian Region.

The paper by **N. S. Bolikhovskaya and R. Makshaev (2020, this volume)** addresses the controversial issues of Late Pleistocene paleogeography in the Caspian basin. The main accent is on palynological investigation of chocolate clays and the overlying and underlying layers from the Srednyaya Akhtuba section. These data are used in the reconstruction of climate and vegetation changes in the Northern Caspian region during the maximum of the Early Khvalynian transgression. The paper is illustrated by pollen diagrams and is supplemented by a detailed list of palynoflora and photographs of pollen belonging to the principal autochthonous taxa, which can then be compared to some re-deposited palynomorphs. Palynological data clearly indicate subaqueal (brackish marine and freshwater) accumulation of sediments within periglacial landscapes and, for the most part, under very harsh climatic conditions. The climate-stratigraphic reconstructions are in agreement with absolute dates on the accumulation of the studied deposits during the Late Valdai (Ostashkov) late Glacial period. During this interval in the territory of the study area, plant communities of the glacial climate—tundra-steppe, periglacial forest-steppe, periglacial steppe, periglacial parklands and periglacial forests—were developed.

The paper by **O. Naidina and K. Richards (2020, this volume)** focuses on palynological study of samples from 12 drillhole-cores recovered in the Urals-Emba region to the northeast of the Caspian Sea. The records reveal vegetation and climate changes for the late Pliocene to early Pleistocene within the time interval from ca. 3.6 to ca. 1.65 Ma. According to the results of the pollen analysis, at the beginning of the Akchagylian stage (3.6–3.4 Ma), there was a cooling and change in structure of the dendroflora, and steppe-dominated landscapes were present. At the end of the early Akchagylian and continuing into the middle Akchagylian, a maximum variety of pollen from tree species occurred. The presence of mesophilic and thermophilic elements signifies that a moderately warm and humid climate occurred at around 3.2 Ma, probably related to the ‘Mid-Pliocene Warm Period’. A second major cooling occurred at around 2.5 Ma coinciding with the onset of northern hemisphere glaciations. At the end of the Akchagylian, at around 1.8 Ma, the climate became more arid, and steppe landscapes were re-established. Results are compared with pollen spectra in surface samples, and with ostracods and foraminiferal assemblages in cores from the study region.

The paper by **A. Zastorozhnoy et al. (2020, this volume)** provides

detailed new data on in-depth studies of the Kosika 1–4 and Borehole 2 Kosika localities by complex biostratigraphic methods based on the study of mollusks, ostracods, mammals, dinoflagellates, and supplemented by lithological data and OSL dates in order to reconstruct the Neopleistocene (Middle-Late Pleistocene) paleoenvironmental history of the Lower Volga area. The authors describe a number of regressive and transgressive stages of the basin related to alterations of humid and arid climate periods. They emphasize that fluvial-marine deposits accumulated in the undersea delta and formed the Baer Knolls. The modern Volga valley was formed during the Holocene.

The paper by **Yu. Bezrodnykh et al.** (2020, this volume) provides an analysis of data on the Holocene sediments of the Northern Caspian Sea obtained by seismoacoustic profiling along with multidisciplinary studies (lithological, malacofaunistic, geochronological-radiocarbon) of bottom sediment cores. These analyses enabled a reconstruction of paleogeographic events at different scales recorded in the geological sequences, such as the Mangyshlak regression and the multi-stage New Caspian transgression, both resulting from climatic changes varying in scale and direction. The large-scale Mangyshlak regression up to -90 m bsl occurred $\sim 11\,600\text{--}8000$ yr BP and corresponded to the Boreal period of the early Holocene. That interval is traceable all over the world and is characterized by high heat supply and aridity. A short-term, sharp cooling known as the “8200 event” and a simultaneous increase in aridity resulted in a maximum drop of the Caspian Sea level at the final stage of the regression. The New Caspian transgression is represented by three transgressive stages separated by short regressions: the 1st stage (8200–5600 yr BP) corresponds to the Holocene optimum; the 2nd stage (3600–3400 yr BP) probably corresponds to the Subboreal cooling and increased moisture on the East European Plain; the 3rd stage occurred after 2300 yr BP. The transgressive stages are characterized by different mollusk assemblages. Smaller-scale fluctuations of sea level resulting from regional climatic changes account for various coastal landforms and characteristics of deltaic deposits. They have been described in many scientific papers.

The paper by **A. A. Svitoch and R. R. Makshaev** (2020, this volume) is devoted to the study of Pleistocene key sections of the Northern Caspian Lowland that are characterized by the incompleteness of the geological record, as expressed in depositional breaks, for which the study examines their duration, causes, and types. Depositional breaks occurred in all periods of the Middle and Late Pleistocene and occupied various time intervals, usually quite continuous, from ~ 230 ka (Cherny Yar) to 100–110 ka (Alexandrov Gay, Gorky Erik, Kopanovka, Entaevka), and rarely shorter: about 10–40 ka (Seroglazovka, Mergenevo). The period of accumulation in these sections is small (3.5–44 ka) and covers only 1–11% (average 3–5%) of represented deposits and less than 10% of the entire chronological record. The total chronological assessment of the incompleteness of the geological record in all studied sections is estimated to be more than 90%. Incompleteness is usually characterized by erosion by river waters of the Volga and Ural system, but more often by abrasion of the Khvalynian and the Khazarian transgressive waters as well as lengthy continuous periods without significant deposition that are often observed under subaerial conditions in the vast watershed area.

Two papers are devoted to the Southern Caspian Region.

The paper by **S. Haghani and S. Leroy** (2020, this volume) describes how the Sefidrud river flowing into the southwestern Caspian Sea is prone to avulsion. Paleoenvironmental studies included sedimentology, macro-remains, and palynology, and these analyses are supplemented by five radiocarbon dates in order to determine avulsion age. Historical maps from around the time of the supposed avulsion as well as more recent times were also studied to provide a complementary way of refining avulsion age. It is shown that the last major avulsion occurred at a date after the early 1800s and before 1929, during a period of rapid water level fall, i.e., several centuries later than was previously suggested. Aerial photographs used in this research confirm the occurrence of a minor avulsion between 1955 and 2014,

where the avulsion point is around 2 km from the coast line, and during a period of sea-level fall. It is suggested that beyond the immediate effects on society and agriculture, avulsion increases the rate of coastal erosion near the abandoned distributary, as sediments are temporarily sequestered on the floodplain; this causes intensive erosion. Avulsion also poses a major impact on coastal lagoons and inland wetlands by river diversion into those lagoons and wetlands.

The paper by **H. Lahijani et al.** (2020, this volume) deals with the South Caspian Sea sub-basin, the deepest part of the Caspian Sea (CS). This basin remained land-locked even during extreme sea level falls that desiccated most parts of the CS. As such, its bottom sediments contain a continuous record of multiple past intra- and extra-basinal events. A study of four short cores from the South Caspian deep basin using sedimentological and geochemical methods revealed several extreme events that have happened since the late Pleistocene, such as frequent turbidite and mass wasting events caused by steep slopes and high sediment supply, several periods of environmental change in the South Caspian sub-basin and catchment area of the sea, and physical weathering and reduced marine biological activities due to the Younger Dryas cold climate event.

Two papers are devoted to the Black Sea Region.

The paper by **D. Jipa and N. Panin** (2020, this volume) is devoted to the characteristics of the associated with the contrasting natural environmental conditions from two Black Sea basin regions: the northwestern/northern and the northeastern/eastern zones. The canyon-associated relief, the morphometric features of the continental shelf and the location of the canyon heads in the two Black Sea areas were analyzed and compared. It was discovered that the canyon system pattern in the northwestern and northern Black Sea zones is quite different. In the deep sea fan areas of the two marine study regions, sediments were supplied in different ways by the canyon systems. The submarine canyons appear as two distinct types: wide-shelf canyons were located in the northwestern/northern zone, and narrow-shelf canyons were located in the northeastern/eastern zones. Sea-level fluctuations affect the wide-shelf and the narrow-shelf canyons in different ways. During highstand conditions, when the shelf is submerged, the wide-shelf canyons become inactive, while the narrow-shelf canyons were active under both lowstand and highstand conditions.

The paper by **A. Okrostsvardize et al.** (2020, this volume) describes the Late Cenozoic subaerial volcanic highland outcrop known as Samtskhe-Javakheti located out in Eastern Anatolia and the western part of the Lesser Caucasus, part of which, located in Georgia. This highland outcrop (~ 4500 km²) is cut by the Mtkvari river canyon, into the thick pyroclastic flow of which was hewn the unique rock-cut city of Vardzia in the twelfth century. The authors demonstrate that the Mtkvari pyroclastic flow is exposed for a distance of about 35 km (from the Karzmeti fortress to the Khertvisi fortress), it is inclined northward by $2\text{--}4^\circ$, and its thickness increases to the north from 40 m up to 80 m. These rocks represent welded, weakly welded, and non-welded ignimbrites of andesitic-dacitic composition. Isotopic parameters of these rocks indicate that they originated as a result of the fractionation of mantle-derived melts. The authors interpret the Mtkvari ignimbrites as products of megacaldera collapse (modern Niala fields), which currently is filled by post-caldera domes of andesitic composition and Quaternary sediments. The zircon dating by the U–Pb method with LA-ICP-MS technology revealed an age of 7.52 ± 0.21 Ma, which corresponds to the Late Miocene epoch. The Vardzia rock-cut city has been carved into weakly welded ignimbrites that are consequently under intensive weathering and erosion. The situation is worsened by the active deep fault running along the Vardzia rock-cut city, which represents a potential earthquake source.

One paper is devoted to the Mediterranean coast of Turkey. **Z. Mohammadi** (2020, this volume) describes the laterally extensive sub-horizontal laminated travertine deposits outcropping in the Çakmak quarry (Denizli Basin, Turkey). The study was based on field observations and detailed petrographic and geochemical analyses (stable

carbon and oxygen isotopes, major and trace elements); the most important controlling porosity-permeability parameters were constrained. This enabled the researchers to subdivide the sub-horizontal travertine succession into three main depositional units and nine dominant lithotypes reflecting an overall shrub flat and marsh pool depositional setting. The former comprises mainly dendritic shrub crust boundstone, pustular grainstone, and clotted micrite mudstone to boundstone. The latter is dominated by coated reed rudstone to boundstone, cryptalgal silty bioclast-rich bioturbated mudstone, and peloidal packstones. The diagenetic study revealed that the sediments were affected by dissolution, cementation, sparmicritization, recrystallization, and local formation of Fe-oxi/hydroxides and chalcedony. These findings ensure an in-depth understanding of continental carbonate deposition, i.e., sub-aqueous travertines, in the context of a lacustrine depositional system.

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References

- Bezrodnykh, Yu., Yanina, T., Sorokin, V., Romanyuk, B., 2020. The northern Caspian sea: environmental consequences of climate change during the Holocene. *Quat. Int* this volume.
- Bolikhovskaya, N.S., Makshaev, R., 2020. The Early Khvalynian stage in the Caspian Sea evolution: pollen records, palynofloras and reconstructions of paleoenvironments. *Quat. Int* this volume.
- Caruso, A., Capraro, L., Di Stefano, A., Marino, M. (Eds.), 2017. Field Trip Guide of IGCP 610 and INQUA IFG POCAS Joint Plenary Conference and Field Trip, pp. 258 2017, Palermo.
- Gilbert, A., Yanko-Hombach, V. (Eds.), 2018. Proceedings of UNESCO – IUGS – IGCP 610 and INQUA IFG POCAS Joint Plenary Conference and Field Trip, October 14–21, 2018, Antalya, Turkey, vol. 202978-605-245-321-6, Doküman Evi, Avcilar, Istanbul.
- Gilbert, A., Yanko-Hombach, V. (Eds.), 2017. Proceedings of IGCP 610 and INQUA IFG POCAS Joint Plenary Conference and Field Trip, pp. 258 Palermo.
- Haghani, S., Leroy, S., 2020. Sediment core, radiocarbon dating, historical maps, sea level change, sedimentology. *Quat. Int* this volume.
- Jipa, D., Panin, N., 2020. Narrow shelf canyons vs. wide shelf canyons. Two distinct types of Black Sea submarine canyons. *Quat. Int* this volume.
- Lahijani, H.A.K., Naderi Beni, A., Tudryn, A., Hosseindoust, M., Habibi, A., Pourkerman, M., 2020. Unraveling extreme events from deep water cores of the south Caspian Sea. *Quat. Int* this volume.
- Mohammadi, Z., Claes, H., Capezzuoli, E., Mozafari, M., Soete, cihan aratman, J., Swennen, S., 2020. Quaternary, middle-upper Pleistocene, Neopleistocene, biostratigraphy, lower Volga area. *Quat. Int* this volume.
- Naidina, O.D., Richards, K., 2020. The Akchagyalian stage (late Pliocene-early Pleistocene) in the North Caspian Region: pollen evidence for vegetation and climate change in the Urals-Emba region. *Quat. Int* this volume.
- Okrostsvaridze, A., Chung, Sun-Lin, Lin, Yu-Chin, Skhirtladze, I., 2020. Geology and zircon U-Pb geochronology of the Mtkvari pyroclastic flow and tvaluation of destructive processes affecting Vardzia, Georgia. *Quat. Int* this volume.
- Svitoch, A.A., Makshaev, R., 2020. Incompleteness of the geological record in middle-upper Pleistocene key sections of the northern caspian Lowland. *Quat. Int* this volume.
- Yanko-Hombach, V., Yanina, T., Kurbanov, R., 2018. INQUA IFG 1709F Ponto-Caspian stratigraphy and geochronology (POCAS). *Quat. Perspect.* 25 (1), 11–12.
- Yanko-Hombach, V., Yanina, T., 2019. Toward an understanding of human responses to environmental change in the Caspian-Black Sea-Mediterranean Corridors (IGCP 610 final report). *Episodes* 42 (4), 343–354.
- Zastrozhnov, A., Danukalova, G., Golovachev, M., Titov, Vadim, Osipova, E., Simakova, A., Yakovlev, A., Yakovleva, T., Alesandrova, G., Shevchenko, A., Murray, A., Tesakov, A., Sadikhov, E., 2020. Biostratigraphical investigations as a tool on palaeoenvironmental reconstructions of the Neopleistocene (Middle-Upper Pleistocene) at the Kosika locality (lower Volga, Russia). *Quat. Int* this volume.

Valentina Yanko-Hombach

*Department of Physical and Marine Geology, Odessa I.I. Mechnikov
National University, Ukraine*

Avalon Institute of Applied Science, Winnipeg, Canada

E-mail addresses: valyan@onu.edu.ua, valyan@avalon-institute.org.