



Paleoclimate activities at CNR-DSSTTA (Annual report - 2021)

INTRODUCTION AND MOTIVATION

In the last century, our society has entered an epoch of global changes, during which humanity has fully acquired the ability to significantly modify the planetary environment. This new period has been named *Anthropocene*, to underline the relevance of humans as a factor of global planetary change. Human population has grown exponentially, the length of life has increased more rapidly than since the dawn of humanity, extreme poverty is still way too widespread but it has been reduced as never before. At the same time, we have forced huge biodiversity losses, polluted air, waters and soils, disrupted the nitrogen cycle, and induced global climatic changes by the emission of greenhouse gases such as carbon dioxide and methane. Climate change can combine with the other hazards, favoring the interplay of multiple risks with potentially dramatic consequences.

Under such circumstances, the only way to address the new challenges generated by climate change is to increase our quantitative knowledge of the Earth System, disentangling to multiple interacting processes governing its dynamics on all space and time scales, by means of measurements, monitoring and modelling, and develop the abilities to estimate future conditions to provide guidance for implementing mitigation and adaptation measures.

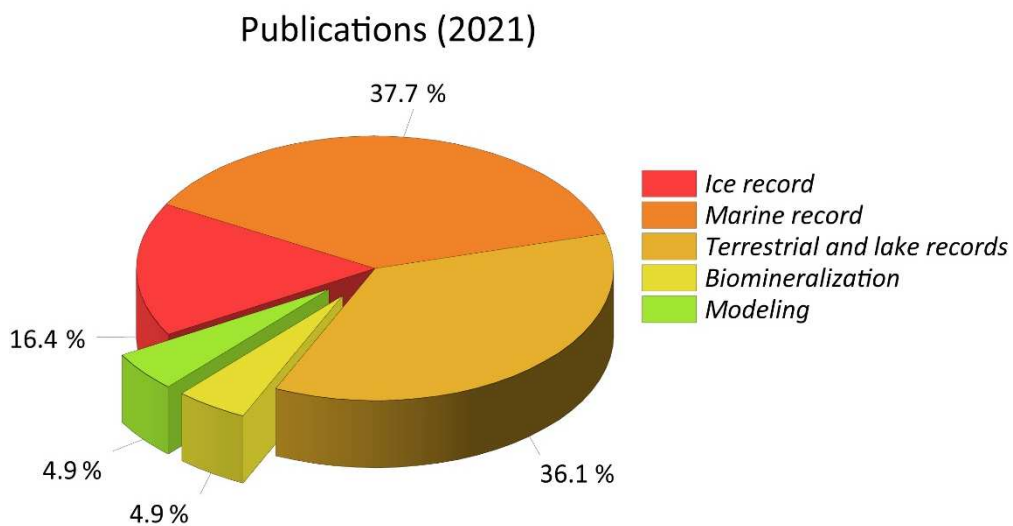
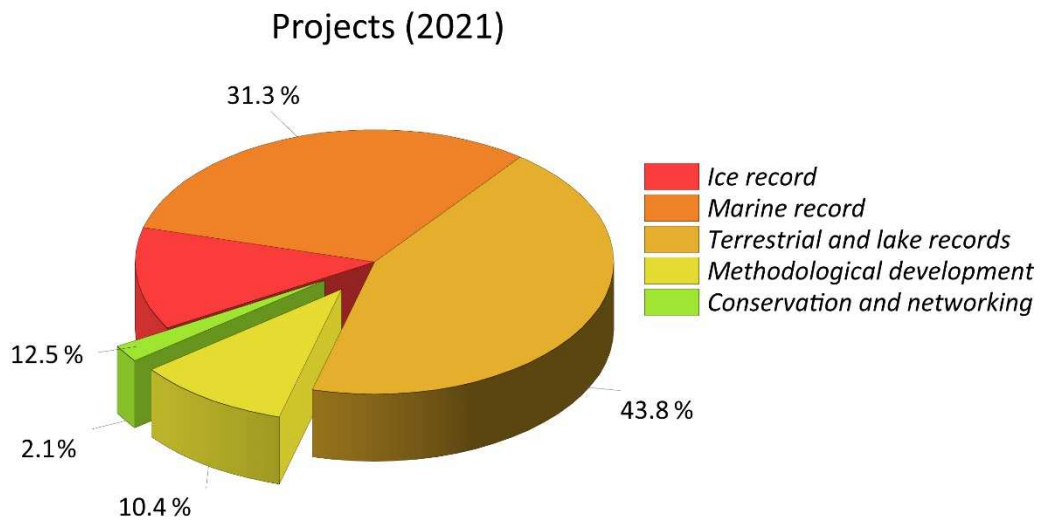
To provide meaningful estimates of future conditions, we need global and regional models, such as those developed by many climate centers in the world (including CNR) and collected for example in the CMIP and CORDEX international programs. However, the climate system is terribly complex, and a full understanding of its workings is still unreached. In particular, models have still troubles in properly dealing with climates that are significantly different from the current one, and in determining the conditions under which the Earth System can reach – and pass through – a tipping point such as collapses in the ocean circulation, generalized permafrost thaw and massive methane emission, or the collapse of the marine biological pump owing to ocean acidification.

Here, the knowledge of past climates can come to help, providing quantitatively measured and measurable “analogues” for what can come in the future. Intense climate changes such as those occurred at the Paleocene-Eocene Thermal Maximum (PETM), or the Eocene-Oligocene cooling, or the many rapid deglaciation warming transitions at the end of the series of glacial maxima in the last million years, with their accompanying short-term fluctuations, provide a glimpse of the possible futures and of the tipping points of the planetary climate system, and can help improving climate models providing a knowledge window on the fully nonlinear processes characterizing the Earth System.

The paleoclimatic research community of DSSTTA CNR, here represented by the Paleoclimate Working Group, is active on many of these themes, and in particular, it focuses on three main issues: (a) the dynamics of climate during the Holocene and the glacial-interglacial cycles across the two main climate system reorganizations of the Quaternary (i.e., the Mid-Brunhes Event and the Middle

Pleistocene Transition), with a specific attention on the Mediterranean, Antarctic and Arctic regions; (b) the dynamics of rapid climate transitions (e.g., glacial terminations and sub-millennial scale variability) and extreme (warm) climate from the Permian to today; and (c) the investigation and calibration of chemical and biological proxies to reconstruct terrestrial and marine climate conditions in the past.

The report and pie charts that follow briefly summarize the research activities done in 2021.



1. ONGOING PROJECTS (2021)

1.1. Paleoclimatic-environmental archives

1.1.1. Ice records

Project	Brief description	Time scale	CNR-Institute	Partner
Beyond EPICA Oldest Ice Core: 1,5 Myr of greenhouse gas – climate feedbacks - ‘Beyond EPICA’ (H2020 #815384)	The overarching scientific objective driving Beyond EPICA is to obtain quantitative, high-resolution ice-core information on climate and environmental changes over the last 1.5 Myr, crossing the enigmatic reorganization of the climatic system of the Middle Pleistocene Transition	Last 1.5 Myr	ISP	AWI UKRI-BAS IPEV, ENEA CNRS, UU NPI, SU UBERN UCPH ULB
EastGRIP – East Greenland Ice core project	Retrieve an ice core by drilling through the Northeast Greenland Ice Stream (NEGIS) and hope to gain new knowledge on ice stream dynamics and past climate	Last 50 kyr	ISP	CIC, AWI, UniBergen, KOPRI, Stockholm University, IGE
Sothern East Dome Ice core project	Ice Core Drilling and the Related Observations at SE-Dome site, southeastern Greenland Ice Sheet for retrieve an high temporal resolution climate record	Last 250 yr	ISP	Hokkaido University
Mt. Brown South ice core project	The Mt Brown South climate record demonstrates how climate is changing in the Indian Ocean basin and constrain the impact of anthropogenic climate change across Antarctica and this poorly understood region of the Southern Hemisphere		ISP	CIC, AAD
SENTINEL - The impact of sea ice diSappearance on highEr North aTlantic climate and atmospheric bromiNe and mErcury cycLes	The disappearance of sea ice in the Barents Sea, and the changing sea ice conditions in the Fram Strait impact heat exchanges between the sea surface and the atmosphere. These in turn could affect mercury deposition rates and the ozone atmospheric lifetime through changes in the amount of bromine radicals released from the first sea ice surface	Last 300 yr	ISP ISAC	NPI, CNRS, UNIVE, ENEA, HZG
PNRA18_00037 "Magma-Ice interaction: late Miocene ice thickness and eruption tempo in northern Victoria Land"	The project is designed for the reconstruction of the ice cover evolution by means of glacial volcanology, igneous petrology and geochronology studies, coupled with investigations of the effects of variable ice load on the eruptibility and composition of magma from shallow crustal chambers	Mainly late Miocene	IGG	UniPisa INGV University of Perugia

1.1.2. Marine records

Project	Brief description	Time scale	CNR-Institute	Partner
INGV-AMUSED “An integrated, multidisciplinary study of past global climate changes from continental and marine archives in the Mediterranean region	The project aims to reconstruct the climatic variability in the central Mediterranean region during the mid-late Quaternary, with a focus on the Holocene, integrating paleoclimatic multi-proxy records acquired from different marine and terrestrial paleoenvironmental archives. For the marine record, marine sediment cores from the Southern Tyrrhenian Sea covering the last 2 kyr will be studied	Mid-Late Quaternary	ISMAR IGAG IRPI ISP	INGV, University of Perugia, Padova, Ca’ Foscari, Palermo
ERC Consolidator Grant “TIMED” Testing the role of Mediterranean thermohaline circulation as a sensor of transient climate events and shaker of North Atlantic Circulation"	This project aims to characterize, qualitatively and quantitatively past changes in the Mediterranean Thermohaline Circulation dynamics in order to understand the distinctive role that individual forcing mechanisms exerted in controlling them. The focus is on specific time windows representing very different transient periods (18-14 ka BP; 9.5-6.5 ka BP and the last 2 kyr) investigated through multi-proxy marine records and deep-sea corals. The paleo-data analysis is integrated with novel climate model paleo-simulations	Late Quaternary	ISMAR	University of Barcelona
C3S_511- Independent Assessment of Essential Climate Variables	This project aims to develop independent assessment framework to evaluate climate records at ocean, atmosphere, land, ice and glaciers domains	Last 20-40 yr	ISMAR	CNR, ENEA, NUIM, LMU, DLR, UCL, ETHZ, CSIC, CLU, VUB
C3S_512- Quality Insurance of Climate Data Store	The objective of this project is to perform quality control of the climate data store of the Copernicus Climate Change Service (C3S)	Last 20-40 yr	ISMAR	BSC, KNMI, FMI, SMHI, DWD, MetFrance
CMEMS_GLO_RAN_Lot6, Validate and Intercomparison of Global Ocean Reanalysis at the tropical Oceans	This project aims to validate the ensemble of ocean reanalyses at the tropical Oceans	Last 30 yr	ISMAR	
The Po-Adriatic source-to-sink system: from modern sedimentary processes to millennial-scale stratigraphic architecture. PASS (PRIN)	The PASS project aims at establishing a framework in which different disciplines integrates high-resolution sequence stratigraphy, sediment provenance and a quantitative assessment of modern sedimentary processes. The goal is to quantitatively assess sediment fluxes across a ~1,000 km long, source-to-sink system by applying a multiscale sequence-stratigraphic method to the chronologically well-constrained post-glacial succession of the Po-Adriatic system	Late Quaternary	ISMAR ISP	University of Bologna

<p>Understanding sapropel deposition in shallow environments (GREAT)</p>	<p>GREAT project focuses on sedimentary archive to provide a new perspective regarding the establishment of anoxic conditions along continental margins. Specifically, GREAT characterize the composition of anoxic/dysoxic deposits and highlight the key mechanisms that led to the formation of sapropel S5, S6 and S7 during profoundly different climatic regimes in terms of sea level, temperature and precipitation</p>	<p>Mid-late Quaternary</p>	<p>ISMAR ISP</p>	<p>ENI</p>
<p>DISGELI Drone-based acquisition and modelling of morpho-stratigraphic data along the Terra Nova Bay (Victoria Land, Antarctica) coastline (PNRA19_00107)</p>	<p>Using innovative technologies, the DISGELI project aims to collect morpho-bathymetric, morpho-topographic and stratigraphic data along the coasts of Terra Nova Bay (Victoria Land, Antarctica) for most of the ice-free summer season, with the main purposes of : i) reconstruct the temporal passages of the retreat of the land line along the marine valleys and local glaciers after the last glacial maximum (LGM); ii) chronologically constrain the deglaciation processes along the coast; and iii) reconstruct the relative sea level changes during the Holocene in better detail than achieved so far</p>	<p>Late Holocene</p>	<p>ISMAR ISP</p>	<p>University of Bologna, Pisa, Bari</p>
<p>Edisto inlet Diatom laminations Sequences Through the Holocene (EDISTHO) – (PNRA18_00010)</p>	<p>The EDISTHO project focus on sediment cores collected inside the Edisto Inlet (Cape Hallett, Western Ross Sea, Antarctica). The aim is to investigate the glaciological and oceanic processes in the Edisto Inlet and their connection with the Ross Sea continental shelf as well as to link them to local, regional and global climatic changes and glacial dynamics</p>	<p>Last 2000 yr</p>	<p>ISP ISMAR</p>	<p>University of Pisa, Trieste, Genova, OGS</p>
<p>Cryptotephra In Marine sequences of the Ross Sea, Antarctica: implications and potential applications (CHIMERA) – (PNRA18_PRDE-6324306)</p>	<p>Multidisciplinary approach involving sedimentology, biostratigraphy, geochemistry, paleomagnetic investigations of sediment sequences and tephrochronology to STUDY THE CRYPTOTEPHRA RECORDS OF THE ROSS SEA. The goal is investigate the potential applications of cryptotephra as continental scale time-markers fundamental for synchronize and correlate marine records with Antarctic tephra archives extrapolating information into a regional to continental framework</p>	<p>Pleistocene-Holocene</p>	<p>ISP ISMAR</p>	<p>INGV, University of Trieste</p>
<p>Cooling over the Victoria Land (GRETA) region: resolving the ocean response to continental climate change during the last two millennia</p>	<p>GRETA investigates the ocean response to a cooling event recorded over the Victoria Land (ca 1.3-1.9 ky CE). Specifically, we will reconstruct the sea ice dynamics and water mass properties in the Ross Sea during this abrupt cooling event using marine sediment archives of the last 2ky</p>	<p>Last 2 ky</p>	<p>ISP ISMAR</p>	<p>INGV, OGS, University of Pisa</p>
<p>Permafrost Thawing: what Happened to the largest terrestrial Carbon pool</p>	<p>PAST-HEAT examines the behavior of permafrost during last deglaciation to improve our knowledge on the post-</p>	<p>LGM-Holocene</p>	<p>ISP ISMAR</p>	<p>OGS</p>

during last deglaciation? Acronym: PAST-HEAT	glacial carbon cycle and elucidate how Arctic soils will respond to climate change			
Deep-sea coral records of Southern Ocean climate and nutrient dynamics	Deep-sea coral and seawater nutrient profiles collected from the Southern Ocean (SO) facing submarine canyons of south-west Australia will be used to provide new insights into the role of the SO overturning circulation in modulating global climate as well as supplying the essential nutrients that make these canyons biodiversity hotspots for seasonal aggregations of killer and blue whales	Last 30 kyr	ISP ISMAR	UWA, LSCE, Max Planck Institute for Chemistry
Bioconstructional organisms from the Ross Sea under Climate Change: ecosystems and 'oasis' of biodiversity to monitor and protect	BIROSS will explore the benthic ecosystems of the Ross Sea focusing on bryozoan, coralline algae, cold-water coral and calcifying sponge bioconstructions and their associated communities in order to build vulnerability maps related to global threats (ocean acidification and global warming). The long-term (paleo) evolution of these vulnerable marine ecosystems will also be studied to investigate potential relationships with temporal variations of key environmental parameters (e.g. seawater temperature, salinity, pH)	Holocene	ISP	ENEA, ISPRA, University of Padova, Genova
Reconstructing the paleo-CO₂ and -pH across a greenhouse-icehouse transition: insights from Eocene-Oligocene $\delta^{11}\text{B}$ Neotethys record (IAS GRANT)	Reconstructing the paleo-CO ₂ and -pH across a greenhouse-icehouse transition: insights from Eocene-Oligocene $\delta^{11}\text{B}$ Neotethys record	Eocene-Oligocene	IGG	IAS

1.1.3. Terrestrial and lake records

Project	Brief description	Time scale	CNR-Institute	Partner
PLIOWEST: drilling Pliocene lakes in western North America (project status: revision in progress, resubmission to ICDP by mid January 2023)	The project aims to gain insights in the step-changes that occurred in the early Pliocene warm period and subsequent Pleistocene cooling accompanying the hydroclimatic changes in this MTC region. Gaining an understanding of the mechanisms involved that may have led to systematic changes in rainfall seasonality and extremes and that may have changed the ecology of the entire region will certainly impact those working in the areas of climate change, water and food security, and environmental sciences	2,5 - 4,5 Myr	IGAG	Kent State Univ., Univ. of Minnesota, George Mason Univ. at Fairfax, Univ. of Zaragoza, Utrecht

Timing and dynamic of the Glacial Termination IX	The project aims to provide a contribution to the knowledge on the role played by the orbital forcing and other factors driving the Pleistocene Glacial Termination (T-#). The goal is to reconstruct, at high temporal resolution, the quantitative temperature variation through the T-IX (ca. 805-790 ka), by means geochemical and geochronological analyses of the lacustrine sediments, spanning the 810-770 ka interval, hosted in the Sulmona Basin (central Italy)	810-770 ka	IGAG IGG	University Melbourne Pisa, Paris-Saclay
FUTURE “Fucino Tephrochronology Unites Quaternary Records” (MIUR – PRIN 2017)	The general objective of FUTURE is to assemble a high-precision ⁴⁰ Ar/ ³⁹ Ar dated tephrochronological record for the last ~430 kyr anchored to a detailed paleoclimate multiproxy record that may be regionally to globally spread via tephrostratigraphic, paleomagnetic and cosmogenic nuclide peak synchronization and paleoclimatic alignments	Last 430 kyr	IGAG IGG	University of Pisa, Roma-Sapienza, Napoli
Climatic variability In central Italy before the Middle-Pleistocene Transition: the succession of the L’Aquila Basin	The project aims to reconstruct the paleoenvironmental and paleoclimatic history from the late Lower Pleistocene lacustrine succession of the San Nicandro Formation (AQ) hosted in L’Aquila Basin, central Italy, through a multi-proxy approach that integrates, sedimentological, micropaleontological, tephrochronological, bio-geochemical and magnetostratigraphical investigations	~1.4-2.1 Ma	IGAG ISMAR IGG	University of Roma-3, Pisa, Firenze, Paris-Saclay, INGV
INGV-AMUSED “An integrated, multidisciplinary study of past global climate changes from continental and marine archives in the Mediterranean region	The project aims to reconstruct the climatic variability in the central Mediterranean region during the mid-late Quaternary, with a focus on the Holocene, integrating paleoclimatic multi-proxy records acquired from different marine and terrestrial paleoenvironmental archives. For the marine record, marine sediment cores from the Southern Tyrrhenian Sea covering the last 2 ka will be studied	~365 ka-Holocene	ISMAR IGAG IRPI ISP	INGV University of Perugia, Padova, Ca’ Foscari, Palermo
VARIIG: Intra-interglacial variability: are warmer periods climatically more unstable?	Variability of the Atlantic Meridional Overturning Circulation during the warm interglacial MIS 9c and cool interglacials MIS 7-ac and 7e	350-300 ka/ 250-190 ka	IGAG	University College London, Pisa, Roma-1
TIMLIGS - Timing of the last interglacial relative sea level highstand	High-precision chronology and magnitude of the relative sea level variability along the Tyrrhenian coast during the Last Interglacial (129-115 ka)	130-100 ka	IGAG	University of Pisa, Roma-2, INGV
Late Holocene climate changes reconstructed from the southern margins of the Arabian Desert, Yemen	Variability of both the Indian Ocean and African monsoon magnitude and the role of northwards migrations of the Intertropical Convergence Zone (ITCZ) vis-à-vis monsoonal dynamics in the region	Last 1200 yr	IGAG	Charney School of Marine Sciences, University of Haifa, Israel

ICDP DOVE - Drilling Overdeepened Alpine Valleys	DOVE intends to recover sediment cores from glacially overdeepened troughs, because their sedimentary infill represents, together with glacial geomorphology, the best preserved but poorly investigated direct archives of the past glaciations cycles in and around the European Alps	Last 2.5 Ma	IGAG IGG	Univ. of Bern, Freiburg, Savoie Mont Blanc, Geological Survey of Slovenia, Leibniz Institute for Applied Geophysics
Past Climate Change and Glaciation at the Alps-Dinarides junction. Slovenian Research Agency (ARRS) – J1 - 2479	On a regional level, we will deliver new findings of how Pleistocene glaciations and Holocene glaciers shaped the environment and how they reacted to past climate variability. This knowledge, although being focused on the south-eastern Alps and northern Dinarides, will also help to better understand past, present and future mountain glacier dynamics on a European scale	Late Pleistocene	ISP	Geological Survey of Slovenia
AL.C.h.E.Mi.S.T. (Albanian Caves as archives of past Environments and climate: Exploring their potential for Scientific research and Touristic development)	Paleoclimatic study of speleothems from selected Albanian caves	Late Quaternary	IGG	MOES Albania
Radiolarian Biostratigraphy of western paraTetis during the Jurassic period	Radiolarian Biostratigraphy of western paraTetis during the Jurassic period	Jurassic	IGG	Niigata University, (Japan)
Living with the supervolcano – How Athesian eruptions destroyed and preserved 15 million years of Permian life	Study of lake basins in the Atesino porphyry complex, to reconstruct the climate change and ecosystems dynamics in the lower Permian in the southern Alps	Permiano	IGG	Research Südtirol/Alto Adige, Ufficio Ricerca scientifica, Provincia autonoma di Bolzano
Evolution of the Alpine glacial systems during the LGM	The chronological and stratigraphic study of the Alpine end-moraine systems is carried out in order to understand the evolution of the Alpine glaciated systems during the LGM. The multidisciplinary study is supported by exposure and radiocarbon dating and facies analysis	Late Pleistocene	IGG	University of Torino, ETH, Austrian Geological Survey
Links between human and environment during the late Quaternary in the Iraqi Kurdistan)	Study of palaeoclimatic and palaeoenvironmental conditions in the Iraqi Kurdistan during the Quaternary and their link with the record of the human development and occupation, through integration of geoarchaeological, geomorphological and geochemical data	Late Pleistocene - Holocene	IGG	University of Milano-Statale, Udine
Changes in paleoproductivity and lake regimes and its relation with past climate anomalies based on photosynthetic	Shallow lakes are complex ecosystems and have become the archetypical example of ecosystem with alternative stable states or regimes. Temperate shallow lakes may be dominated	Last 1000 yr	IRSA	Instituto de Investigacione s Marinas y Costeras (IIMyC),

pigments in shallow lakes of the Pampa plain (Argentina) over the last millennium.	alternatively by charophytes, submerged angiosperms, green algae, diatoms or cyanobacteria. Clear and turbid regimes occur at low/intermediate and intermediate/high nutrient levels, respectively. Regime shift can be defined as the sudden drastic transition from one persistent dynamical regime to another and may be due to different mechanisms, such as drastic impact on the system or stepwise change in some important external condition			CONICET- Mar del Plata, Argentina
Sedimentary perspective on UV radiation and organic carbon fluctuations in mountain lakes”.	The project explores connections between solar radiation, aquatic carbon cycling and climate change focusing on mountain lakes in Arctic (Finnish Lapland) and alpine (Italian Alps) environments	Last 200 yr	IRSA	University of Helsinki
Geo-ecosystems in Transition on the Tibetan Plateau (TransTiP)	Lake sediments will provide information about long-term hydrological variability and evolution of water quality. Quantification of runoff, meltwater and groundwater contributions to the hydrological budget will allow to test the effects of hydrological events on the aquatic ecosystem as well as help to disentangle these components archived in lake sediment records. Overall, the identification of the local components of the water balance and an integral approach of surface and subsurface flow modeling with water balance studies will provide assessments of past and future dynamics of water fluxes and water quality	Last 2000 yr	IRSA	Institute of Geosystems and Bioindication (IGeo) Technische Universität Braunschweig, Braunschweig, Germany Institute of Tibetan Plateau Research Chinese Academy of Sciences, P.R. China
Biochemical responses of lakes to rapid climate transitions across space and time: insights from novel high-resolution analyses of sediments from Europe and Northern China	Here, we capitalize on the methodological achievements and extend our research up to multiple lake sites in several regions and long (103-105 years) time-scales with the goal to (i) systematically investigate the multiple biochemical responses of lakes (aquatic productivity, successions of algal communities, possible limiting factors such as N, P, Si or light, anoxia and P cycle feedbacks) to high-amplitude rapid climate transitions in the past (Dansgaard Oeschger Cycles and Glacial-Interglacial transitions), and (ii) to explore the frontiers and limits of our method with applications on long time-scales	Holocene/Pl eistocene	IRSA	University of Bern, Gdansk, Mainz, GFZ Helmholtz Centre Potsdam University of Science and technology, Hefei, China
Ricostruzione ambientale del sito archeologico Val Liona, Vicenza, Italia	Collaborazione nell’ambito del ERC-Consolidator "GEODAP: Geoarchaeology of Daily Practices" coordinato dal Prof. Cristiano Nicosia, Uni Padova	Neolitico		University of Padova, Salento, Ca’ Foscari

Multiproxy high-resolution evidence from annually laminated sediments discloses Southern European ecosystem responses to climate change at Monticchio, Italy	Laminated sediments recovered from the maar lake Lago Grande di Monticchio in southern Italy not only provide detailed information about the regional climatic and environmental development but also about the explosive activity of nearby (100-540 km) Quaternary Italian volcanoes. A total of 345 distal tephra layers are intercalated in the sediments of the 133 ka Monticchio record	Last 130 kyr	IRSA	GFZ-Potsdam, University of Portsmouth, La Sapienza, Uppsala, Bern
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1.2. Methodological development

Improved polycyclic aromatic hydrocarbons and n-alkanes determination in speleothems through cleanroom sample processing	In this work, we developed a novel method for the simultaneous determination of 18 polycyclic aromatic hydrocarbons (PAHs) and 26 n-alkanes (C10–C35) and then tested it on “clean” calcite and aragonite stalagmite samples from cave KNI-51 in the Australian tropics. The method involves subsampling by using a hand-held drill, complete dissolution of the matrix in hydrochloric acid, then liquid–liquid extraction, and GC-MS analysis		ISP	Cornell College
Fast Liquid Chromatography Coupled with Tandem Mass Spectrometry for the Analysis of Vanillic and Syringic Acids in Ice Cores	In this work, we develop an innovative method through the combination of fast liquid chromatography coupled with tandem mass spectrometry (FLC-MS/MS) to continuously determine to quantify the vanillic and syringic acids, two specific markers for biomass burning		ISP	University Ca' Foscari
GC-MS method for determining faecal sterols as biomarkers of human and pastoral animal presence in freshwater sediments	analytical method based on pressurised liquid extraction (PLE), clean-up performed using solid phase extraction (SPE) and sterol determination using gas chromatography–mass spectrometry (GC-MS) analysis to determine sterols and stanols in freshwater sediments to reconstruct the past presence of humans and pastoral animals		ISP	University Ca' Foscari
Observation-aware dynamical downscaling of sub-seasonal to seasonal predictions onto the Mediterranean region and Lazio area	The DYNAMOL project aims to use the multi-model ensemble of global seasonal forecasts provided by the Copernicus Climate Change Service (C3S, https://climate.copernicus.eu) as initial and boundary conditions for the high-resolution regional model		ISMAR	ENEA
Improved sedimentary structures study through embedding unconsolidated samples for thin section analyses	In this project, we refined the method for the impregnation of unconsolidated sediments with > 60 % of water content to study undisturbed small-scale sedimentary structures (mm- to cm-scale) and textures (mm to μm scale features, particle organisation) diagnostic of depositional processes. The method involves replacing pore waters with Spurr resin, sub-samples sectioning, and electron microscopy analysis		ISMAR	

1.3. Conservation and networking

ICE-Memory	It is an international research project recognized by UNESCO. The aim of this project is to create a sanctuary for non-polar ice core samples in Concordia, the Franco-Italian research station in Antarctica, in order to allow future generations of scientists to continue to analyze them. Ice memory's international team plans to drill 20 glaciers over the next two decades.	ISP	University Ca' Foscari CNRS, IRD, IPEV
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2. MEETING AND WORKSHOP ORGANIZATION

Title	Institute
Beyond EPICA Science Consortia in-presence Meeting (LSCE campus - Gif-sur-Yvette, France, 12-13 October 2021)	ISP
PAIGES: Chronologies for Polar Paleoclimate Archives – Kickoff conference of a new Italian–German partnership project (Bologna and Venice, Italy, 6-8 October 2021) https://pastglobalchanges.org/publications/pages-magazines/pages-magazine/129044	ISP
AIQUA scientific virtual tours - webinar seminar (n.7)	ISMAR
Notte Europea dei Ricercatori (24 Settembre)	ISMAR-ISP

3. PUBLICATIONS (2021)

References	Topic	Institute
1. Antonioli F., Furlani S., Montagna P., Stocchi P. (2021). The use of submerged speleothems for sea level studies in the Mediterranean Sea: A new perspective using glacial isostatic adjustment. <i>Geosciences</i> , 11, 77.	Marine record	ISP
2. Antonioli F., Furlani S., Montagna P., Stocchi P., Calcagnile L., Quarta G., Cecchinell J., Lo Presti V., Morticelli M., Foresta Martin F., Pons-Branchu E., Vaccher V. (2021). Submerged speleothems and sea level reconstructions: A global overview and new results from the Mediterranean Sea. <i>Water</i> , 13, 1663.	Marine record	ISP
3. Argiriadis E., Bortolini M., Kehrwald N. M., Roman M., Turetta C., Hanif S., Erhenhi E. O., Ramirez Aliaga J. M., McWethy D. B., Myrbo A. E., Pauchard A., Barbante C., Battistel D. (2021). Rapa Nui (Easter Island) Rano Raraku crater lake basin: Geochemical characterization and implications for the Ahu-Moai Period. <i>PLoS ONE</i> 16(10): e0254793. https://doi.org/10.1371/journal.pone.0254793	Lake sediment record	ISP
4. Ben Dor Y., Marra F., Armon M., Enzel Y., Brauer A., Schwab M. J., Morin E. (2021). Hydroclimatic variability of opposing Late Pleistocene climates in the Levant revealed by deep Dead Sea sediments, <i>Clim. Past</i> , 17, 2653–2677, https://doi.org/10.5194/cp-17-2653-2021	Lake sediment record	ISAC
5. Bonomo S., Schroeder K., Cascella A., Alberico I., Lirer F. (2021). Living coccolithophore communities in the central Mediterranean Sea (Summer 2016): Relations between ecology and oceanography. <i>Marine micropaleontology</i> . http://dx.doi.org/10.1016/j.marmicro.2021.101995 .	Marine record	IGAG ISMAR
6. Brandano M., Cornacchia I., Catanzariti R., Tomassetti L. (2021). The Monterey Event in the Mediterranean platform to basin transition: The Guadagnolo Formation (Miocene, Prenestini Mountains, Central Apennines). <i>Palaeogeography, Palaeoclimatology, Palaeoecology</i> , 564, 110177.	Marine record	IGG
7. Burgay F., Barbaro E., Cappelletti D., Turetta C., Gallet J.-C., Isaksson E., Stenni B., Dreossi G., Scoto F., Barbante C. (2021). First discrete iron(II)	Ice core record	ISP

	records from Dome C (Antarctica) and the Holtedahlfonna glacier (Svalbard). <i>Chemosphere</i> 2021, 267, 129335.		
8.	Burgay F., Spolaor A., Gabrieli J., Cozzi G., Turetta C., Vallelonga P., Barbante C. (2021). Atmospheric iron supply and marine productivity in the glacial North Pacific Ocean, <i>Clim. Past</i> , 17, 491–505.	Ice core record	ISP
9.	Capotondi L., Bertini A., Falcucci E., Furlani S., Monegato G., Peresani M., Palombo M. R., Petrosino P., Ravazzi C., Zerboni A., Mazzini I. (2021). Using the past to envisage a better future: The approach of a Quaternary scientist. <i>Alpine and Mediterranean Quaternary</i> , 34(2), 1–19.	Marine record	ISMAR IGAG IGG
10.	Cascella A., Bonomo S., Lirer F., Margaritelli G., Checa H., Cacho I., Pena L., Frigola J. (2021). The response of calcareous plankton to the Sapropel S1 interval in North Ionian Sea. <i>Global and planetary change</i> . http://dx.doi.org/10.1016/j.gloplacha.2021.103599 .	Marine record	IGAG ISMAR IRPI
11.	Castellano L., Pini R., Ravazzi C., Furlanetto G., Valoti F. (2021). Palynological insights into the ecology and economy of ancient bee-products: a contribution to the history of beekeeping. In (a cura di D. Wallace-Hare) - New Approaches to the Archaeology of Beekeeping. Archaeopress Publishing Ltd, Oxford. ISBN: 978-1-78969-993-7 e 978-1-78969-994-4 (e-pdf). Pp. 59-78.	Terrestrial record	IGAG
12.	Colin C., Duhamel M., Siani G., Dubois-Dauphin Q., Ducassou E., Liu Z., Wu J., Revel M., Dapoigny A., Douville E., Taviani M., Montagna P. (2021). Changes in the intermediate water masses of the Mediterranean Sea during the last climatic cycle: New constraints from neodymium isotopes in foraminifera <i>Paleoceanography and Paleoclimatology</i> , 36, e2020PA004153.	Marine record	ISP ISMAR
13.	Cornacchia I., Brandano M., Agostini S. (2021). Miocene paleoceanographic evolution of the Mediterranean area and carbonate production changes: A review. <i>Earth-Science Reviews</i> , 103785.	Marine record	IGG
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17.	Di Roberto A., Scateni B., Di Vincenzo G., Petrelli M., Fisauli G., Barker S.J., Del Carlo P., Colleoni F., Kulhanek D.K., McKay R., De Santis L. (2021). Tephrochronology and provenance of an early Pleistocene (Calabrian) tephra from IODP Expedition 374 Site U1524, Ross Sea (Antarctica). <i>Geochemistry, Geophysics, Geosystems</i> , https://doi.org/10.1029/2021GC009739	Ice core record	IGG
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19.	Enrichi F., Dahl-Jensen D., Steffensen J.P., Barbante C. (2021). Theoretical and Experimental Analysis for Cleaning Ice Cores from EstisoltM 140 Drill Liquid. <i>Appl. Sci.</i> 11, 3830. https://doi.org/10.3390/app11093830	Ice core record	ISP

20. Ferretti A., Malferrari D., Savioli M., Medici L. (2021) 'Conodont pearls' do not belong to conodonts. <i>Lethaia</i> 54(3), 300-313.	Biom mineralization	IMAA
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27. Isola I, Mazzarini F., Piccini L., Zanella E., Zanchetta G., Drysdale R.N., Hellstrom J., Woodhead J., Roncioni A., Milazzo D., Pieruccioni D., Regattieri E. (2021). New chronological constraints from hypogean deposits for late Pliocene to recent morphotectonic history of the Alpi Apuane (NW Tuscany, Italy). <i>Geosciences</i> , 11(2), 65	Terrestrial record	IGG
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30. Manea E., Bergami C., Bongiorno L., Capotondi L De Maio E., Oggioni A., Pugnetti A. (2021). A transnational marine ecological observatory in the Adriatic Sea to harmonize a fragmented approach to monitoring and conservation. <i>Advances in Oceanography and Limnology</i> , 12, n.1.	Marine Record	ISMAR
31. Marchetto A., Boggero A., Fontaneto D., Lami A., Lotter A., Manca M., Massafiero J., Mosello R., Musazzi S., Nickus U., Psenner R., Rogora M., Stundet S., Stuchlik E., Tartari G., Thies H., Tolotti M. (2021). Living organisms and sedimentary remains from high mountain lakes in the Alps. <i>Journal of Limnology</i> , 80, https://doi.org/10.4081/jlimnol.2021.2036	Lake record	IRSA

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33. Matamales-Andreu A., Mujala E., Dinarès-Turell J., Kustatscher E., Roghi G., Oms O., Galobarta A. & Fortunya J. (2021). Early–middle Permian ecosystems of equatorial Pangaea: integrated multi-stratigraphic and palaeontological review of the Permian of Mallorca (Balearic Islands, western Mediterranean). <i>Earth-Science Reviews</i> 222, 103783.	Terrestrial record	IGG
34. Mazzini I, Aiello G, Frenzel P, Pint A. (2021). Marine and marginal marine Ostracoda as proxies in geoarchaeology. <i>Marine Micropaleontology</i> , 174, 102054.	Marine record	IGAG
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36. Medici L., Savioli M., Ferretti A., Malferrari D. (2021) Zooming in REE and Other Trace Elements on Conodonts: Does Taxonomy Guide Diagenesis? <i>Journal of Earth Science</i> 32(3), 501-511.	Biom mineralization	IMAA
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39. Moser D.E., Jackson S., Kjær H.A., Markle B., Ngoumtsa E., Pedro J.B., Segato D., Spolaor A., Tetzner D., Vallenga P., Thomas E.R (2021). An Age Scale for the First Shallow (Sub-)Antarctic Ice Core from Young Island, Northwest Ross Sea. <i>Geosciences</i> 11, 368.	Ice core record	ISP
40. Nardin R., Severi M., Amore A., Becagli S., Burgay F., Caiazzo L., Ciardini V., Dreossi G., Frezzotti M., Hong S.-B., Khan I., Narcisi B. M., Proposito M., Scarchilli C., Selmo E., Spolaor A., Stenni B., Traversi R. (2021). Dating of the GV7 East Antarctic ice core by high-resolution chemical records and focus on the accumulation rate variability in the last millennium, <i>Clim. Past</i> , 17, 2073–2089.	Ice core record	ISP
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44. Peresani M., Monegato G., Ravazzi C., Bertola S., Margaritora D., Breda M., Fontana A., Fontana F., Janković I., Karavanic I., Komso D., Mozzi P., Pini R., Furlanetto G., De Amicis M, Perhoč Z., Posth C., Ronchi L., Rossato S., Vukosavljević N., Zerboni A. (2021). Hunter-gatherers across the Great	Terrestrial record, archaeological record	IGAG IGG

	Adriatic-Padanian Region during the Last Glacial Maximum: environmental and cultural dynamics. <i>Quaternary International</i> , 581-582, 128-163.		
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47.	Raichich F., Colucci R.R. (2021). A mean-sea-level pressure time series for Trieste, Italy (1841–2018). <i>Earth System Science Data</i> 13, 3363-3377.	Historical data	ISP
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49.	Regattieri E., Querci S., Zanchetta G., Zanella E., Isola I., Drysdale R.N., Hellstrom J.C., Magri F. (2021). Interstadial conditions over the Southern Alps during the early penultimate glacial (MIS 6): a multiproxy record from Rio Martino Cave (Italy). <i>Quaternary Science Reviews</i> , 257, 106856.	Terrestrial record	IGG
50.	Rettig L., Monegato G., Mozzi P., Žebre M., Casetta L., Ferneti M., Colucci R.R. (2021). The pleistocene evolution and reconstruction of LGM and late glacial paleoglaciers of the Silisia Valley and Mount Raut (Carnic Prealps, NE Italy). <i>Alpine and Mediterranean Quaternary</i> 34(2), 277-290.	Terrestrial record	IGG ISP
51.	Sanchez-Cabeza J.A., Rico-Esenaro S.D., Corcho-Alvarado J.A., Rollin S., Carricart-Gavinet J.P., Montagna P., Ruiz-Fernandez A.C., Cearreta A. (2021). Plutonium in coral archives: A good primary marker for an Anthropocene type section. <i>Science of the Total Environment</i> , 145077.	Marine record	ISP
52.	Segato D., et al. (2021). Five thousand years of fire history in the high North Atlantic region: natural variability and ancient human forcing. <i>Clim. Past</i> , 17(4), 1533-1545	Ice core record	ISP
53.	Spolaor, A., Burgay, F., Fernandez, R.P. et al. Antarctic ozone hole modifies iodine geochemistry on the Antarctic Plateau. <i>Nat Commun</i> 12, 5836 (2021).	Ice core record	ISP
54.	Storto A, Balmaseda M. A., de Boisseson E., Giese B., Masina S., Yang C. (2021). The 20 th century global warming signature on the ocean at global and basin scales as depicted from historical reanalyses. <i>International Journal of Climatol.</i> , 41, 5977–5997.	Marine Record	ISMAR
55.	Tekleva M.V., Polevova S.V., Gavrilova O.A., Roghi G., Neri M. (2021). Pseudoschizaea sp. from the Early Jurassic of Italy: Fine Structure and Comparison. <i>Paleontological Journal</i> , 55, 224–234.	Terrestrial record	IGG
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57.	Torricella F., Melis R., Malinverno E., Fontolan G., Bussi M., Capotondi L., Del Carlo P., Di Roberto A., Geniram A., Kuhn G., Khim B. K., Morigi C., Scateni B., Colizza E. (2021). Environmental and oceanographic conditions at the continental margin of the Central Basin, northwestern Ross Sea (Antarctica) since Last Glacial Maximum. <i>Geosciences</i> , 11 (4), 155.	Marine Record	ISMAR
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Temperature intercomparison in the framework of the Copernicus Climate Change Service (C3S), <i>Journal of Climate</i> , 34(13), 5257-5283.		
60. Zanchetta G., Bini M., Bloomfield K., Izdebski A., Vivoli N., Regattieri E., Isola I., Drysdale R.N., Bajo P., Hellstrom J.C., Wisniewski R., Fallick A.E., Natali S., Luppichini M. (2021). Beyond one-way determinism: San Frediano's miracle and climate change in Central and Northern Italy in late antiquity. <i>Climatic Change</i> , 165(1), 1-21.	Terrestrial record	IGG
61. Žebre M., Colucci R.R., Giorgi F., Glasser N.F., Racoviteanu A.E., Del Gobbo C. (2021). 200 years of Equilibrium-Line Altitude variability across the European Alps (1901–2100). <i>Climate Dynamics</i> , 56, 1183-1201.	Historical data and Modeling study	ISP
62. Žebre M., Sarikaya M., Akif, Stepišnik U, Colucci R.R., Yildirim C., Çiner A., Candao A., Vlahović Š., Tomljenović B., Matoš B., Wilcken K.M. (2021). An early glacial maximum during the last glacial cycle on the northern Velebit Mt. (Croatia). <i>Geomorphology</i> 392, 107918.	Terrestrial record	ISP

4. ONGOING PHD THESIS

Istituto di Scienze Polari (ISP)

Alessio Nogarotto - PhD in Polar Sciences

High resolution paleoenvironmental and sea ice reconstruction of the last 30 ky in polar regions: a combination of geochemical proxies from marine and glacial archives

Ca' Foscari University of Venice - Cotutor ISP

Chiara Pambianco - PhD Polar Sciences

Feedbacks to climate from Polar Regions during the last deglaciation: insights from Compound Specific Radiocarbon Analyses (CSRAs)

Ca' Foscari University of Venice - Cotutor ISP

Giuditta Celli - PhD in Polar Sciences

The influence of the Antarctic ozone hole on geochemical cycles

Ca' Foscari University of Venice - Cotutor ISP

Delia Segato - PhD in Science and management of climate change

Long-term sea ice reconstruction through halogens speciation in polar ice cores

Ca' Foscari University of Venice - Cotutor ISP

Giulia Genuzio - PhD in Polar Sciences

Great Acceleration In Antarctica An ice core high-resolution, multi-proxy approach"

Ca' Foscari University of Venice - Cotutor ISP

Azzurra Spagnesi - PhD in Polar Sciences

Development of a new CFA sistem for ice core analysis, and paleoclimatological characterization of the Grand Combin alpine site based on dust, organic fraction and heavy metals in the framework of the Ice Memory Project

Ca' Foscari University of Venice - Cotutor ISP

Istituto di Scienze Marine (ISMAR)

Jacopo Busatto - PhD in Engineering

Understand the air-sea interaction and the climate change in the Agulhas Current areas

University of Roma Tre - Cotutor ISMAR

Irene Sammartino - PhD in Earth Sciences

Characterization of sediment provenance in the Adriatic Sea based on geochemical parameters

Supervisor ISMAR

Istituto di Geologia Ambientale e Geoingegneria (IGAG)

Pablo Vera Polo - PhD in Earth Sciences

Unveiling timing and dynamic of Marine Isotope Stage 11c interglacial: a high-resolution pollen record from Fucino Basin, central Italy

University of Roma (La Sapienza) - Cotutor IGAG

Cecile Vittori Villette - Docteur de l'Université de Strasbourg en Géographie Physique - Paléoenvironnements littoraux
Trajectoires temporelles longues des lagunes côtières de Méditerranée et sociétés anciennes : L'apport des ostracodes fossiles

Université de Strasbourg - Cotuteurs CNRS, Université Lumière Lyon 2, IGAG

Massimo Domenico Novellino - PhD in Geosciences

Landscape evolution in Northern Adriatic regions in the Late Pleistocene

University of Padova - Cotutor IGAG

Istituto di Geoscienze e Georisorse (IGG)

Luca Forti - PhD in Earth Sciences

Geoarchaeological and palaeoenvironmental reconstruction of the Late Quaternary climate-environmental-human nexus in Iraqi Kurdistan

DST A-Desio, UniMi Statale - Cotutor IGG

Monica Pernice - PhD in Earth Sciences

Mediterranean paleo-CO₂ reconstruction from Neogene to present

DST UniSiena-Uni Sapienza - Cotutor IGG

Sarah Kamleitner - PhD in Earth Science

Timing and extent of LGM glaciers N and S of the Alps

ETH Zurigo - Cotutor IGG

Lukas Rettig - PhD in Earth Science

The reconstruction of the Equilibrium Line Altitude in the southern side of the Alps during the LGM

Geosciences UniPD - Cotutor IGG

Mina Mazaherijohari - PhD in Earth and Marine Sciences

Carnian Pluvial Episode in Iran (Turan plate and Iran plate) and western Tethys domain

UniFe - Cotutor IGG