

## **Attività paleoclimatiche al CNR-DSSTTA**

### **Annual report 2022**

Gruppo di Lavoro “Dinamica del Paleoclima”

Climate change refers to the long-term alteration in Earth's climate parameters, including temperature, precipitation, wind patterns, cryosphere extent and other factors, primarily resulting from human activities. Human become a major agency of Global Change since the late Holocene in some regions, but it is especially after the Industrial Revolution that human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020 (IPCC-AR6 2023). This warming trend has been observed across all continents and oceans.

Impacts of climate change are far-reaching and affect both natural and human systems. Among others, shifts in ecosystems and habitats, loss of biodiversity, rising sea levels, desertification and increase in the frequency and severity of extreme weather events, are increasingly accelerating. Consequences include food and water scarcity, health risks, economic disruptions, and social conflicts. Vulnerable communities, including those in low-lying coastal areas or arid regions, are particularly at risk.

Addressing climate change requires global efforts to reduce greenhouse gas emissions, promote sustainable land management practices, protect and restore ecosystems, and enhance resilience to climate impacts. A deep understanding of how the Earth System works is also required. This involves exploring the multitude of interacting processes governing its dynamics across all spatial and temporal scales through measurement, monitoring, and modeling.

Paleoclimatology plays a crucial role in understanding the trajectories of future climate. Natural archives from the geological and ice records preserve in their physical, stratigraphical and biogeochemical properties the conditions that existed during their formation. Past climate states in the Earth's history span a tremendous range of temperatures, precipitation patterns, cryospheric extent, and biospheric adaptations. Their reconstruction can provide the required benchmark of natural conditions and background variability, helping to understand the responses of habitats and ecosystems to different combination of climate and environmental forcing and enhancing our understanding on how key elements of the climate system are affected by greenhouse gas levels, variation in solar radiation, ice extent, and so on.

Furthermore, the frontier challenge of paleoclimate research is to test Earth System Models over selected past climate scenarios, outside the range of variability recorded over the past centuries. This can help to predict the potential impacts of increased global warming and can offer insights into extreme climate events, threshold mechanism and tipping points that may occur in the future.

The paleoclimatic community at the CNR-DSSTTA, here represented by the “Paleoclimate dynamics working group” is active in many sub-fields of paleoclimatic research. Different methodological approaches, ranging from biostratigraphy, paleoecology, geochemistry, sedimentology, mineralogy, geochronology are employed to reconstruct past climates, environments and ecosystems from natural archives spanning the marine, terrestrial and ice realms. Physical modelling and proxy calibrations through modern observations are also developed. Investigations and reconstructions

range from the deep geological time, to the Quaternary, to the present interglacial and the last few hundreds of years, with increasing level of details. The general aims are:

- Documenting and quantifying the natural climate variability, in terms of amplitude, time (onset, duration, frequency), space (location, extension), impacts (on environment and ecosystems), as well as regional to global teleconnections.
- Describing short- to long-term climate evolution using different proxies, specifically from past climate periods that are of particular relevance with respect to the current and future climate change scenario (e.g. Quaternary Interglacials and deglaciations, intervals of rapid global warming such as the Eocene-Paleocene transition, the Middle Miocene Climatic Optimum, the Pliocene Optimum etc.).
- Reconstruct ecologic and environmental baselines from pristine and increasingly impacted environments, and the ecosystems and habitats sensitivity to both natural and anthropic change.
- Investigate and calibrate chemical and biological proxies to quantitatively reconstruct climatic and environmental parameters in the past.

The present report, based on survey in the different DSSTTA Institutes, aims to summarize the paleoclimatic activities in the CNR-DSSTTA for the 2022.

In general, it shows that large part of the paleoclimate research at the CNR is focused on climatic hot-spots such as the Mediterranean, polar and mountain regions. Both national and international collaborations are well developed, as testified also by the participation to large scientific consortia/projects such as ICDP/IODP, ERC, PNRA, PRA etc. Collaboration with the University is strong, and involves both student tutoring from bachelor to Ph.D level, with a particular focus on the PhD in Polar Sciences, as well as teaching. Synergies between different Institutes are present, but most of the activities involves single or small groups of CNR researchers. A wide array of projects is developed thanks to informal collaborations and networking, often leading to high-quality scientific production despite the lack of dedicated funding. Overall, the scientific production is large and nuanced, and well placed in terms of bibliographic indexes, though open-access publications are still limited.

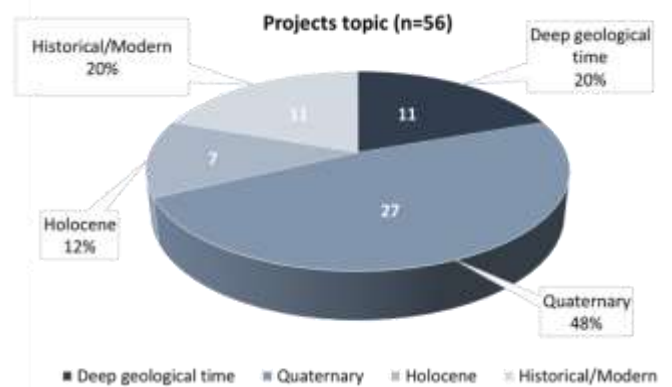
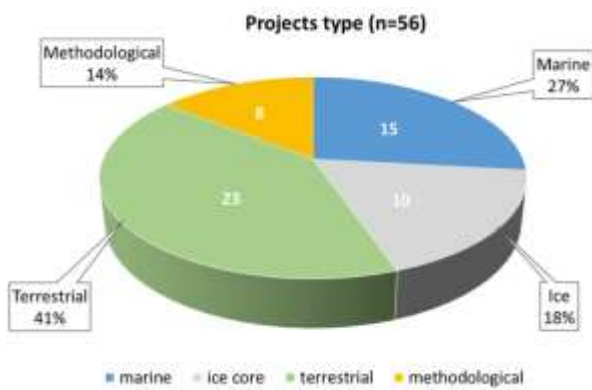
A special mention among the 2022 activities is deserved for the International workshop “Climate Change and Carbon Cycle: Global change from the Deep past to the Anthropocene”, (C<sup>4</sup> workshop) 22-24 June 2022, Pisa (Italy), co-organized by the “Paleoclimate Dynamics and the “Carbon Cycle” working groups. The workshop, sponsored by PAGES (Past Global Change) was attended by over 70 people - most of them early career scientists - coming from 10 different countries. The workshop consisted of three different sessions: Processes, Impacts and Frontiers. During the workshop, the participants travelled in space and time, from the Triassic-Jurassic mass extinction (~201 Ma) to the consequences of the 2020 lockdown on river carbon cycle in Tuscan watersheds. Contributions covered research topics over different latitudes from the Arctic to Antarctica and over different climate from the Alpine Critical Zone to the Mediterranean Sea as well as urban environments. In addition, five different laboratories were organized, with the goal to get the participants familiar with new concepts and methodologies outside their scientific background. laboratories included forest modelling, IODP drilling initiatives, soil geochemistry, terrestrial ecosystem monitoring, marine carbon cycle and carbonate rocks.

The overall inclusive approach of C<sup>4</sup> workshop succeeded with gathering scientists working on topics of common interest despite the different research tools and time scales.

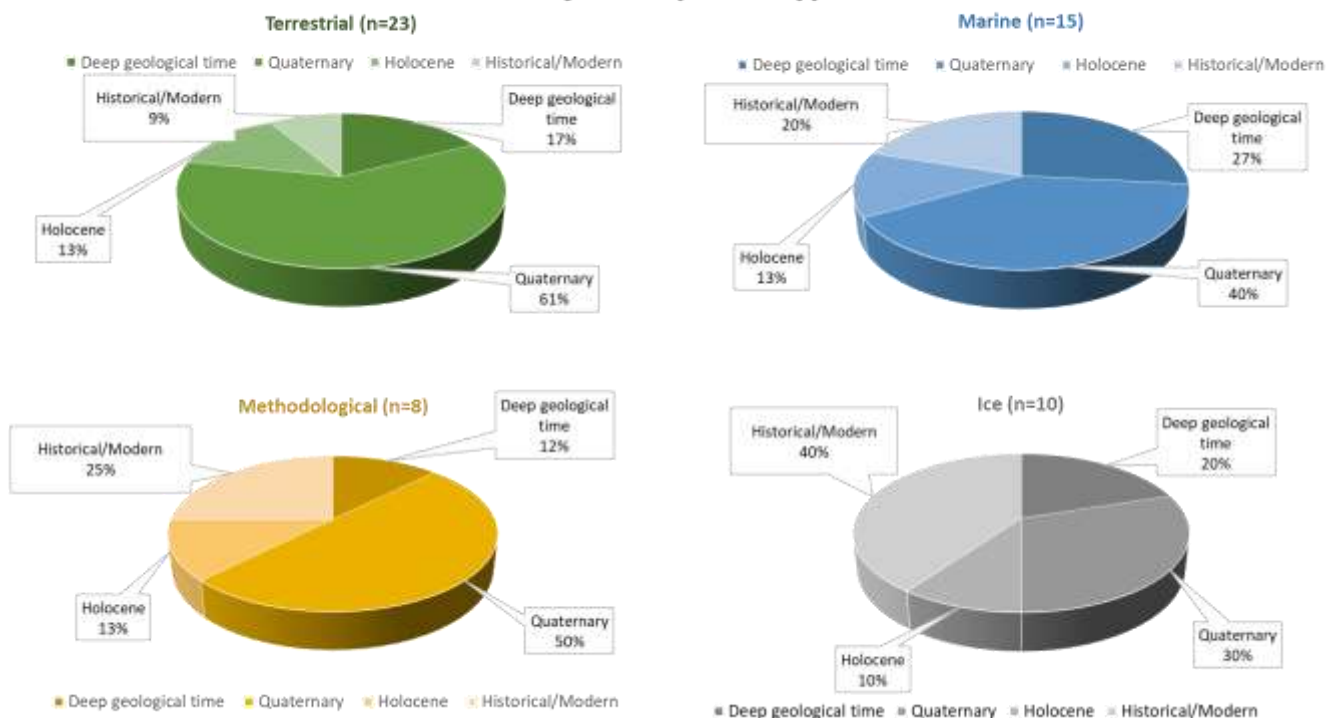
The following tables and pie-charts highlight projects and publications stats for topic and type. The full list of projects, activities and publications follows.

### Projects (n=56)

<i>Topic</i> \ <b>Type</b>	marine	ice core	terrestrial	methodological	total
<i>Deep geological time</i>	4	2	4	1	<b>11</b>
<i>Quaternary</i>	6	3	14	4	<b>27</b>
<i>Holocene</i>	2	1	3	1	<b>7</b>
<i>Historical/Modern</i>	3	4	2	2	<b>11</b>
<b>total</b>	<b>15</b>	<b>10</b>	<b>23</b>	<b>8</b>	<b>56</b>

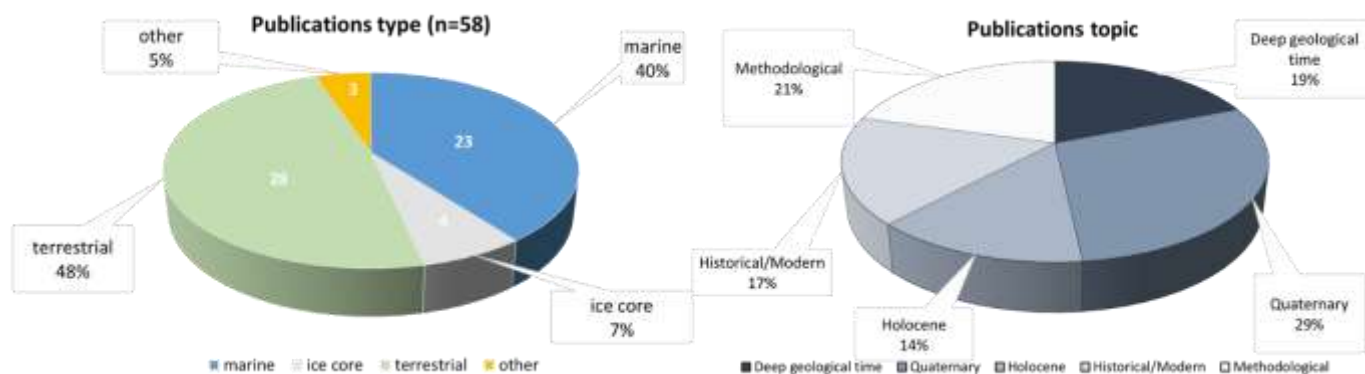


## Projects topic for type

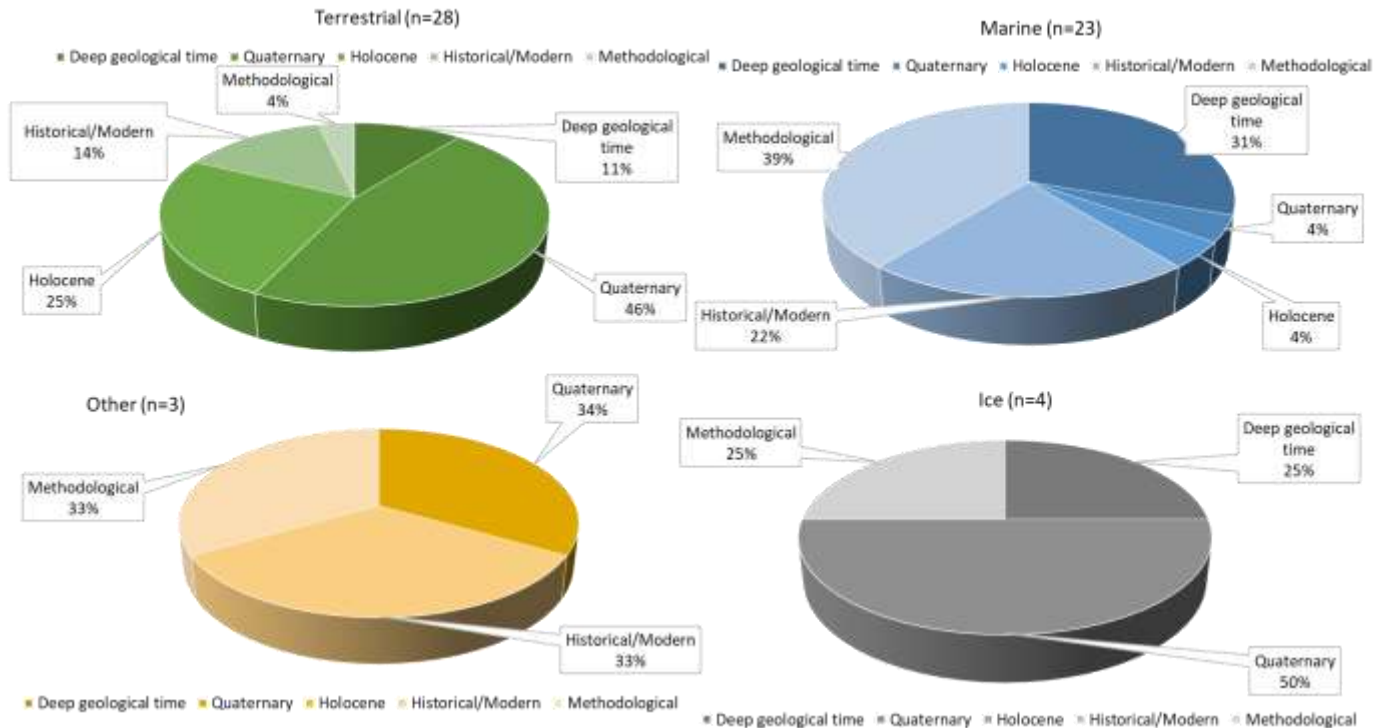


## Publications (n=58)

	marine	ice core	terrestrial	other	total
<i>Deep geological time</i>	7	1	3	0	11
<i>Quaternary</i>	1	2	13	1	17
<i>Holocene</i>	1	0	7	0	8
<i>Historical/Modern</i>	5	0	4	1	10
<i>Methodological</i>	9	1	1	1	12
<b>total</b>	<b>23</b>	<b>4</b>	<b>28</b>	<b>3</b>	<b>58</b>



## Publications topic for type



### 1. ONGOING PROJECTS

#### 1.1. Paleoclimatic-environmental archives

##### 1.1.1. Ice records

Project	Brief description	Time scale	CNR-Institute	Partner
<b>PNRA18_00037 "Magma-Ice interaction: late Miocene ice thickness and eruption tempo in northern Victoria Land"</b>	Reconstruction of the ice cover evolution by means of glacial volcanology, igneous petrology and geochronology, coupled with investigations of the effects of variable ice load on the eruptibility and composition of magma from shallow crustal chambers	Mainly late Miocene	<b>IGG</b>	UniPisa, UniPerugia INGV
<b>PNRA18_00233 Antarctic Ice Sheets' dynamics: new data from provenance and paleontological analysis of IODP374 and DSDP Leg28 cores in the Ross Sea</b>	Interaction between glacial processes, sedimentary processes and climatic evolution, to better constrain ice flow modelling. The project is based a multi-disciplinary approach including; ostracod analysis, their C-O stable isotope analysis, clast petrography and petrology, and, limited to DSDP cores, also on combined detrital thermochronology and geochronology.	Oligocene-Miocene	<b>IGG</b>	UniSiena, UniPadova, UniTrieste
<b>Beyond EPICA Oldest Ice Core: 1,5 Myr of greenhouse gas – climate feedbacks - 'Beyond EPICA' (H2020 #815384)</b>	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	Last 1.5 Myr	<b>ISP</b>	AWI UKRI-BAS IPEV, ENEA CNRS, UU NPI, SU

	Myr, crossing the enigmatic reorganization of the climatic system of the Middle Pleistocene Transition			UBERN UCPH ULB Venice University
<b>EastGRIP – East Greenland ice core project</b>	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	<b>ISP</b>	CIC, AWI, UniBergen, KOPRI, Stockholm University, IGE
<b>Southern East Dome ice core project</b>	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	<b>ISP</b>	Hokkaido University (Japan)
<b>Mt. Brown South ice core project</b>	The Mt Brown South climate record demonstrates how climate is changing in the Indian Ocean basin and constrains the impact of anthropogenic climate change across Antarctica and this poorly understood region of the Southern Hemisphere	Last 1200 yr	<b>ISP</b>	CIC, AAD
<b>SENTINEL - The impact of sea ice disappearance on highEr North aTlantic climate and atmospheric bromiNe and mErcury cycles</b>	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	<b>ISP ISAC</b>	NPI, CNRS, UniVenezia, ENEA, HZG
<b>Ricerche paleoecologiche e microbiologiche sulla successione di ghiaccio nel ricovero di Monte Scorluzzo (Parco Nazionale dello Stelvio)</b>	Analysis of micro- and macroscopic botanical remains preserved in ice formed at the end of World War I in the Scorluzzo cave, aiming to: (i) explore the biodiversity preserved in ice; (ii) analyze the processes of accumulation of organic and mineral particles (airborne dispersal, percolation, runoff, transport mediated by plant material used inside the shelter, by humans and/or animal furs); (iii) check for contamination due to episodes of ice melting and after ice dismantling.	Last 100 years	<b>IGAG</b>	UniPadova, UniMilano Statale, Fondazione E. Mach, MUSE Trento
<b>Stratigrafia integrata di proxies pollinici e sedimentari in una carota di ghiaccio dall'Adamello (Pian di Neve)</b>	Analysis of microbotanical proxies extracted from the ADA270 ice core and comparison with co-registered proxies (dust, isotopes, Cs, <sup>3</sup> H, etc.)	Last 1000 years	<b>IGAG</b>	UniMilano Bicocca, POLIMI, FLA, Edison, Valcamonica Servizi, Regione Lombardia

### 1.1.2. Marine records

Project	Brief description	Time scale	CNR-Institute	Partner
<b>INGV-AMUSED “An integrated, multidisciplinary study of past global climate changes from continental and marine archives in the Mediterranean region</b>	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	<b>ISMAR IGAG IRPI ISP IGG</b>	INGV, UniPerugia, UniPadova, UniVenezia, UniPalermo
<b>Reconstructing the paleo-CO<sub>2</sub> and -pH across a greenhouse-icehouse transition: insights from Eocene-Oligocene <math>\delta^{11}\text{B}</math> Neotethys record (IAS GRANT)</b>	Reconstructing the paleo-CO <sub>2</sub> and -pH across a greenhouse-icehouse transition: insights from Eocene-Oligocene $\delta^{11}\text{B}$ Neotethys record	Eocene-Oligocene	<b>IGG</b>	IAS
<b>Reconstructing the paleo-C and -O across the PETM interval in the Friuli-Adriatic platform</b>	Paleo-C and -O across the Paleocene-Eocene hyperthermal (PETM) and faunal turnover	Paleocene – Eocene	<b>ISMAR</b>	UniFerrara, UniTrieste, UniModena
<b>Reconstructing paleotemperatures at the Cenomanian-Turonian (OAE2) interval in the Friuli-Adriatic platform</b>	Paleo-C and -O and clumped isotopes across the Cenomanian-Turonian hyperthermal (OAE2) and faunal turnover	Cretaceous (Cenomanian-Turonian)	<b>ISMAR</b>	UniFerrara, UniTrieste,
<b>Mesozoic carbonate platforms as valuable archive of local and global changes</b>	Integrated Stratigraphy (sedimentology, biostratigraphy, cyclostratigraphy, sequence stratigraphy, chemostratigraphy, palynology) and high-resolution correlations of Cretaceous shallow-water carbonate platform successions in order to reconstruct paleoenvironmental perturbations and short-to-long-term paleoclimatic/paleoceanographic changes.	Cretaceous (Aptian-Cenomanian)	<b>ISMAR</b>	UniBari; State Authority for Mining, Energy and Geology (DE)
<b>ESA CCI+ SLBC (Sea level budget optimization algorithms)</b>	The general objectives of the project are to improve the closure of the global mean Sea level budget and extend the global Sea level budget time series,	30 years	<b>ISMAR</b>	Magellium, LEGOS, NERSC, UniBologna, UniBristol (UK), UniDresen (DE), Daltas
<b>Cryptotephra In Marine sequences of the Ross Sea, Antarctica: implications and potential applications (CHIMERA) – (PNRA18_PRDE-6324306)</b>	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	Pleistocene-Holocene	<b>ISP ISMAR</b>	INGV, UniTrieste

	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			
<b>Edisto inlet Diatom laminations Sequences Through the Holocene (EDISTHO) – (PNRA18_00010)</b>	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	Last 2000 yr	<b>ISP ISMAR</b>	UniPisa, UniTrieste, UniGenova, OGS
<b>CoolinG overR thE VicToria LAnd (GRETA) region: resolving the ocean response to continental climate change during the last two millennia</b>	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	Last 2 ky	<b>ISP ISMAR</b>	INGV, OGS, UniPisa
<b>DISGELI Drone-based acquiSition and modelling of morpho-stratigraphic data along the Terra Nova Bay (Victoria Land, Antarctica) coastline (PNRA19_00107)</b>	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	Late Holocene	<b>ISMAR ISP</b>	UniBologna, UniPisa, UniBari
<b>UnderstandinG sapRopel dEposition in shAllow environemEnts (GREAT)</b>	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	Mid-late Quaternary	<b>ISMAR ISP</b>	ENI
<b>The Po-Adriatic source-to-sink system: from modern sedimentary processes to millennial-scale</b>	The PASS project aims at establishing a framework in which different disciplines integrates high-resolution sequence stratigraphy, sediment provenance and a quantitative	Late Quaternary	<b>ISMAR ISP</b>	UniBologna



<b>stratigraphic architecture. PASS (PRIN)</b>	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			
<b>Deep-sea coral records of Southern Ocean climate and nutrient dynamics</b>	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	<b>ISP ISMAR</b>	UWA (DE), LSCE (FR), Max Planck Institute for Chemistry (DE)
<b>Bioconstructional organisms from the Ross Sea under Climate Change: ecosystems and 'oasis' of biodiversity to monitor and protect (BIOROSS – PNRA18_00237)</b>	BIOROSS 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	<b>ISP</b>	ENEA, ISPRA, UniPadova, UniGenova
<b>PermAfroSt Thawing: what Happened to the largest tErrestrial cArbon pool during lastT deglaciation? Acronym: PAST-HEAT</b>	The last deglaciation is a warming phase following the Last Glacial Maximum (21ky ago). Models suggest that, during this transition, permafrost thawing exerted a positive feedback on climate change by releasing CO <sub>2</sub> /CH <sub>4</sub> into the atmosphere. Processes and timing of carbon release remain, however, elusive. PAST-HEAT will examine the behavior of permafrost during last deglaciation to improve our knowledge on the post-glacial carbon cycle and elucidate how Arctic soils will response to climate change	Last 20-30 ky	<b>ISP ISMAR</b>	OGS

### 1.1.3. Terrestrial and lake records

Project	Brief description	Time scale	CNR-Institute	Partner
<b>INGV-AMUSED “An integrated, multidisciplinary study of past global climate changes from continental and marine archives in the Mediterranean region</b>	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 terrestrial record, a lacustrine sediment cores from the Castiglione basin (Latium) covering the last 350 ka is under investigation.	~365 ka-Holocene	<b>ISMAR IGAG IRPI ISP IGG</b>	INGV UniPerugia, UniPadova, UniVenezia UniPalermo
<b>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)</b>	Sampling and geochemical and geochronological study of speleothems from selected Albanian caves, to reconstruct late Quaternary paleoenvironment and climate	Late Quaternary	<b>IGG</b>	MOES Albania INGV UniPisa
<b>Radiolarian Biostratigraphy of western Tethys during the Jurassic period</b>	Radiolarian Biostratigraphy of western paraTetis during the Jurassic period	Jurassic	<b>IGG</b>	Niigata University, (Japan)
<b>Living with the supervolcano – How Athesian eruptions destroyed and preserved 15 million years of Permian life</b>	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	Permian	<b>IGG</b>	Research Südtirol/Alto Adige, Ufficio Ricerca scientifica, Provincia autonoma di Bolzano
<b>Evolution of the Alpine glacial systems during the LGM</b>	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	<b>IGG</b>	UniTorino, ETH (CH), Austrian Geological Survey
<b>Links between human and environment during the late Quaternary in the Iraqi Kurdistan)</b>	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	<b>IGG</b>	UniMilano-Statale, UniUdine
<b>Australian Research Council, Discovery Project “New insights on the forcing of Quaternary ice-age terminations”</b>	This project investigates the period 1.0 to 1.4 Ma ,when Earth's climate last experienced a major step change. It combines information from an exceptional archive of cave deposits and ocean sediments to precisely determine the timing of ice-age cycles.	Early Pleistocene	<b>IGG</b>	UniMelbourne (AU), Cambridge University (UK)

<b>MUR-FISR "S-P-HERITAGE - Lezioni per il futuro dal patrimonio culturale del passato: quattrocentomila anni di risposta delle popolazioni umane alle variazioni del livello del mare e ai cambiamenti climatici nel Mediterraneo Nord-Occidentale</b>	Geomorphological, biostratigraphic, geoaerchological and geochemical study of coastal sites in the Ligurian Sea, to investigate: the magnitude and timing of past sea level changes, the past vulnerability to global warming of coastal ecosystem biodiversity; the response of past human communities to environmental changes caused by coastline modifications.	Middle-Late Pleistocene-Holocene	<b>IGG</b>	UniPisa, UniMilano Statale
<b>SNOOP "San Nicandro palaeolake borehole Project</b>	Paleoenvironmental and paleoclimatic change in the Central Apennine before the Middle Pleistocene Transition from a lake succession in L'Aquila Basin, central Italy (Castenuovo, AQ)	Pleistocene	<b>ISMAR IGAG IGG</b>	UniRoma TRE, INGV
<b>Transformations of the terrestrial ecosystems during the Carnian Pluvial Episode: high-resolution study of non-marine successions from the northern and southern hemispheres</b>	Biostratigraphic study of terrestrial sequences from the Carnian Pluvial episode	Triassic	<b>IGG</b>	China University of Geosciences
<b>PNRA18_00184 Multidecadal Biogenic Compounds and Nutrients Characterization in Coastal Lake Sediments (BioCyCLEs)</b>	Characterization of nutrients and biomarkers in the lipid fraction of sediments from coastal lakes of Antarctic ice-free areas.	Late Holocene	<b>ISP</b>	UniRoma1 UniRoma2
<b>NBFC – National Future Biodiversity Center</b>	The NBFC aims to promote biodiversity conservation, monitoring, restoring and rewinding in Italy and in the Mediterranean, challenging the global warming, the sustainability of human impacts and the role of long-term processes, including climate, in driving the contemporary ecological changes. IGG, ISAC, IGAG and IRET take part in spoke 4 – activities 4.2.-4.3-4.4. ISMAR .....	5 ka to present	<b>IGG ISAC IGAG ISMAR IRET</b>	Comprehensive list of cooperating institutions at <a href="https://www.nbfc.it/">https://www.nbfc.it/</a>
<b>ICDP-DOVE (Drilling Overdeepened Alpine Valleys) step 1 master cores - Biostratigraphy of long Quaternary sedimentary records from the northern side of the Alps</b>	This project aims at generating new knowledge on the Quaternary history of overdeepened Alpine valleys through biostratigraphic analysis of terrestrial proxies on relevant long cores drilled in Switzerland, Germany and Italy for the ICDP-DOVE project.	Last 2.5 Ma	<b>IGAG IGG</b>	University of UniBern (CH), University of Freiburg (DE)
<b>The biogeographic role of the Balkan Peninsula as a Middle to Upper Palaeolithic migration route for modern humans. An exploratory study through new archaeological,</b>	Improve the current knowledge about the timing and the environmental-climatic contexts in which modern humans lived during the Palaeolithic period in south-eastern Europe	Late Pleistocene	<b>IGAG</b>	Academy of Albanological Studies, Tirana UniFerrara, Leibniz Inst. for Applied Geophysics at

<b>chronological and palaeoecological analysis in Albania</b>				Freie UniBerlin (CH)
<b>PLIOWEST: DRILLING PLIOCENE LAKES IN WESTERN NORTH AMERICA</b>	Insights in the step-changes that occurred in the early Pliocene warm period and subsequent Pleistocene cooling accompanying the hydroclimatic changes in NW US region. Understanding the mechanisms involved in changes in rainfall seasonality. Proposal in corso di risottomissione ad ICDP.	Last 4.5 million years	<b>IGAG</b>	Kent State University, UniMinnesota (USA), Instituto Pirenaico de Ecologia (ES), UniUtrecht (DE), UniManchester (UK).
<b>VALMARES - VALMALenco REsearch</b>	In search of ancient pastures - dating peat successions, soils and glacial deposits at the dairy Alpine farmers of Campagneda and Fellaria (Valmalenco, Italian Alps)	Holocene	<b>IGAG</b>	Unione Comuni Valmalenco
<b>Per una storia ambientale del Parco Nazionale dello Stelvio. Strumenti e metodi di ricerca interdisciplinare e multidisciplinare sulla storia dell'interazione uomo/animali/ambiente/paesaggio dall'anno Mille al tempo presente</b>	Environmental changes in the National Stelvio Park deciphered from natural stratigraphic archives.	Holocene	<b>IGAG</b>	Parco Nazionale dello Stelvio, UniBergamo, UniBologna, UniInsubria, Fondazione AEM
<b>The Middle Pleistocene Transition in the Mediterranean during MIS 28-19 (c. 1.0-0.8 Ma)</b>	Timing and dynamic of the paleoenvironmental and paleoclimatic change during the Middle Pleistocene transition by high-resolution multiproxy data (scanning XRF element geochemistry, CaCO <sub>3</sub> content, TIC and TOC, $\delta^{18}O_{calcite}$ , pollen) from a 100 m-long lacustrine succession from Sulmona Basin, central Italy	Pleistocene (1.0-0.8 Ma)	<b>IGAG-IGG</b>	UniMelbourne (AU), UniPisa, UCLondon (GB), UniParis-Saclay (FR)
<b>Timing and dynamic of the Glacial Termination IX</b>	The project aims 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).	Pleistocene 810-770 ka	<b>IGAG-IGG</b>	UniMelbourne (AU), UniPisa, UniParis-Saclay (FR)
<b>FUTURE "Fucino Tephrochronology Unites Quaternary Records" (MIUR – PRIN 2017)</b>	The general objective of FUTURE is to assemble a high-precision <sup>40</sup> Ar/ <sup>39</sup> 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.	Pleistocene Last 430 kyr	<b>IGAG-IGG</b>	UniPisa, UniRoma1, UniNapoli

<b>VARIIG: Intra-interglacial variability: are warmer periods climatically more unstable?</b>	Variability of the Atlantic Meridional Overturning Circulation during the warm interglacial MIS 9c and cool interglacials MIS 7-ac and 7e	Pleistocene (350-300 ka/ 250-190 ka)	<b>IGAG</b>	UCLondon (GB); UniPisa, UniRoma1
<b>TIMLIGS - Timing of the last interglacial relative sea level highstand</b>	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	<b>IGAG</b>	UniPI, UniRoma-2, INGV

#### 1.1.4 Others

<b>Geological Mapping project (CARG) - Geological map of Italy at the scale 1:50.000- in progress</b>	Sheets 177 Tortona & 195 Novi Ligure	Permian to Quaternary	<b>IGG</b>	UniTorino
	Sheet 087 Palmanova e 061 Borgo Valsugana	Permian to Quaternary	<b>IGG</b>	UniPadova
	Sheet 121 Brescia	Mesozoic to Quaternary	<b>IGAG</b>	UniMilano Statale Museo di Scienze di Brescia

#### 1.2. Methodological development

<b>Project</b>	<b>Brief description</b>	<b>Time scale</b>	<b>CNR-Institute</b>	<b>Partner</b>
<b>NSF Grant 2147186: Field and Laboratory Tests of Pyrogenic Organic Compounds in Australian Stalagmites as a Novel, High-Resolution Paleofire Proxy</b>	i) measurements of organic compounds such as PAHs in soil and cave dripwater prior to, immediately following, and a year after a prescribed burn over the cave site, (ii) replication of pyrogenic organic compound distributions in a coeval stalagmite sample, and (iii) comparison of the paleofire signals in a 20th century stalagmite to remote sensing data and records of fire derived from historical documents	Late Holocene	<b>ISP</b>	Cornell College (USA)
<b>Determinations of Boron isotopes on calcitic shells and forams</b>	The main analytical limitations are the low amount of B in calcitic shells and the contamination from other minerals, We addressed these main issues i) applying a cleaning procedure of foraminifera tests mutated from Barker et al. (2003) and Pena et al. (2005); ii) implementing the Neptune Plus MC-ICP-MS to increase the analytical sensitivity of the instrument iii) controlling instrumental fraction effects during the analyse (bracketing).		<b>IGG</b>	

<b>Improve Historical Ocean reanalyses products</b>	In this work, we aim to improve the quality of historical ocean reanalyses (1900-2022) by using different initial conditions, data assimilation strategies.		<b>ISMAR</b>	UniReading (UK)
<b>C3S2_520_CNR - Evaluation and Quality Control of Copernicus Climate datasets</b>	Quality control of climate datasets in the frame of Copernicus		<b>ISMAR</b>	Met Norway, CMCC, ENEA, Colab+Atlantic, VUB, B-Open, CSIC, TCDF, NERSC, CNRS
<b>Improve halogen speciation method in ice core</b>	The methodology is based on coupling ICP-SFMS with IC. The developed methods Improved the detection limits, improved method accuracy and precision		<b>ISP</b>	ISP\UNIVE\ CSIC\ UniManitoba\ Kopri
<b>upgraded CFA – FLC – MS/MS system for the continuous detection of levoglucosan in ice cores</b>	A new Continuous Flow Analysis (CFA) system coupled with Fast Liquid Chromatography – tandem Mass Spectrometry (FLC-MS/MS) for determining organic markers in ice cores to increase the sampling resolution (down to 1 cm)		<b>ISP</b>	
<b>Fast Liquid Chromatography Coupled with Tandem Mass Spectrometry for the Analysis of Vanillic and Syringic Acids in Ice Cores</b>	Fast liquid chromatography coupled with tandem mass spectrometry (FLC-MS/MS) to continuously determine organic markers in ice cores for the quantification of vanillic and syringic acids, two specific markers for biomass burning		<b>ISP</b>	
<b>ICARE - Inter-Calibration <sup>40</sup>Ar/<sup>39</sup>Ar et Radiocarbone en Europe entre 10 000 et 40 000 ans BP</b>	ICARE aims at improving the calibration curve for the radiocarbon the most common and powerful geochronometer of the Earth's and human history for the last 55 kyr. This goal will be achieved by acquiring <sup>40</sup> Ar/ <sup>39</sup> Ar and <sup>14</sup> C paired ages and correlating, via geochemical data, several proximal and distal tephra, sourced by Neapolitan volcanoes (Italy) during the 12-40 ka interval.		<b>IGAG</b>	UniParis-Saclay, LSCE (FR), INGV, UniBari, UniPerugia

## 2. MEETING AND WORKSHOP ORGANIZATION

<b>Title</b>	<b>Institute</b>
<p>“Climate Change And Carbon Cycle” Report: <a href="#">Cornacchia I.</a>, <a href="#">Boschi C.</a>, <a href="#">Braico P.</a>, <a href="#">Cristofanelli P.</a>, <a href="#">Iadanza A.</a>, <a href="#">Montagna P.</a>, <a href="#">Regattieri E.</a> and <a href="#">Tesi T.</a> (2022). Gathering an interdisciplinary community to explore carbon cycle complexities over the history of the Earth. Report of the Workshop “Climate Change and Carbon Cycle”, 22-24 giugno 2022, Pisa, Italy. PAGES Magazine, volume 30(2).</p>	<p><b>gdl Paleoclima</b></p>

## 3. PUBLICATIONS (2022)

References	Topic		Institute
Aiello, G., Mazzini, I., Parisi, R., Ingrassia, M. & Barra, D. 2022. Are CO2-rich seafloor pockmarks a suitable environment for ostracod assemblages? The example of the Zannone Giant Pockmark (central-eastern Tyrrhenian). <i>Marine Ecology</i> , vol. 43, no. 3.	Marine record	Methodological - observation	IGAG
Amalfitano J, Dalla Vecchia F.M., Carnevale G., Fornaciari E., Roghi G. and Giusberti L., 2022, Morphology and paleobiology of the Late Cretaceous large-sized shark <i>Cretodus crassidens</i> (Dixon, 1850) (Neoselachii; Lamniformes), <i>Journal of Paleontology</i> . doi: 10.1017/jpa.2022.23.	Marine record	Deep geological time	IGG
Anselmetti, F.S., Bavec, M., Crouzet, C., Fiebig, M., Gabriel, G., Preusser, F., Ravazzi, C., Ariztegui, D., Beraus, S., Brandt, A.-., Buechi, M., Bunes, H., Burschil, T., Dehnert, A., Deplazes, G., Götzl, G., Firla, G., Gegg, L., Graf, H.R., Heeschen, K., Kipfer, R., Kroemer, E., Lüthgens, C., Monegato, G., Neuhuber, S., Pini, R., Reitner, J., Salcher, B., Schaller, S., Schmalfuss, C., Schmelzbach, C., Scholger, R., Schuster, B., Stumpf, A., Tanner, D.C., Thomas, C., Tomonaga, Y., Wieland-Schuster, U. & Wonik, T. 2022. Drilling Overdeepened Alpine Valleys (ICDP-DOVE): Quantifying the age, extent, and environmental impact of Alpine glaciations. <i>Scientific Drilling</i> , vol. 31, pp. 51-70.	Terrestrial record	Quaternary	IGAG
Baldovin, M., Cecconi, F., Provenzale, A., & Vulpiani, A. (2022). Extracting causation from millennial-scale climate fluctuations in the last 800 kyr. <i>Scientific reports</i> , 12(1), 1-12.	modelling	Quaternary	IGG
Barbaro, Elena, et al. "Fast Liquid Chromatography Coupled with Tandem Mass Spectrometry for the Analysis of Vanillic and Syringic Acids in Ice Cores." <i>Analytical Chemistry</i> 94.13 (2022): 5344-5351.	Ice core Record	Methodological - observation	ISP
Bortolini M., Agnoletto F.C., Argiriadis E., Nicosia C., McWethy, D.B., Devos, Y., Stortini A.M., Baldan M., Roman M., Vendrame T., Scaggiante R., Bruno B., Pojana G., Battistel D. 2022. Insight into the carbonaceous fraction of three cultural layers of different age from the area of Verona (NE Italy). <i>Catena</i> , 217, 106453.	Terrestrial record	Holocene	ISP
Brandano, M., Cornacchia, I., & Catanzariti, R. (2022). Fault-Block Platform Evolution between Late Cretaceous and Early Miocene along the Margin of the Latium-Abruzzi Carbonate Platform (Southern Preneestini Mountains, Central Apennines, Italy). <i>Geosciences</i> , 12(9), 348.	Marine record	Deep geological time	
Cammarano, D., Becherini, F., Leolini, L., Camuffo, D., Moriondo, M., della Valle, A., Ferrise, R. Impact of long-term (1764-2017) air temperature on phenology of cereals and vines in two locations of northern Italy. <i>Italian Journal of Agronomy</i> , 2022, 17, 2164. DOI: 10.4081/ija.2022.2164	Terrestrial record	Historical-modern	ISAC ISP
Camuffo, D. A discussion on sea level rise, rate ad acceleration. Venice as a case study. <i>Environmental Earth Sciences</i> , 2022, 81:349 DOI: 10.21203/rs.3.rs-1073418/v1	Marine record	Historical-modern	ISAC ISP
Camuffo, D. Historical documents as proxy data in Venice and its marine environment. <i>Oxford Research Encyclopedia of Climate Science</i> . Oxford University Press, Oxford, 2022. pp. 1-47, DOI: 10.1093/acrefore/9780190228620.013.875	Marine record	Historical-modern	ISAC
Camuffo, D. Wind-driven rain impinging on monuments and mountain slopes. <i>Journal of Cultural Heritage</i> , 2022, 55: 149-157 DOI: 10.1016/j.culher.2022.03.007	terrestrial record	Historical-modern	ISAC ISP

Camuffo, D., della Valle, A., Becherini F. How the rain-gauge threshold affects the precipitation frequency and amount, <i>Climatic Change.</i> , 2022, 170(7) DOI: 10.1007/s10584-021-03283-x	terrestrial	Historical-modern	<b>ISAC ISP</b>
Capotondi L., Kaminski M A, Mancin N. 2022. The test wall of ?Nubeculina Cushman 1924 (Miliolida): updates on its agglutinated-porcelaneous wall structure from entire and sectioned specimens. <i>Micropaleontology</i> , vol 68,n.6: 557-567	Marine record	Methodological - observation	<b>ISMAR</b>
Capotondi, L.; Bonomo, S.; Graiani, A.; Innangi, M.; Innangi, S.; Giglio, F.; Ravaoli, M.; Ferraro, L. Spatial Distribution of Benthic Foraminifera in the Neretva Channel (Croatia Coast): Faunal Response to Environmental Parameters. <i>Geosciences</i> <b>2022</b> , 12, 456. <a href="https://doi.org/10.3390/geosciences12120456">https://doi.org/10.3390/geosciences12120456</a>	Marine record	Methodological - observation	<b>ISMAR</b>
Cardello, G. L., Tomassetti, L., Cornacchia, I., Mancini, A., Mancini, M., Mazzini, I., Lorenzi, V. Petitta, M., Girotti, O. and Brandano, M., 2022. The Tethyan and Tyrrhenian margin record of the Central Apennines: a guide with insights from stratigraphy, tectonics, and hydrogeology. <i>Geological Fieldtrips and Maps</i>	Marine record	Deep geological time	<b>IGG</b>
Chuvilin, E., Bukhanov, B., Yurchenko, A., Davletshina, D., Shakhova, N., Spivak, E., Rusakov, V., Dudarev, O., Khaustova, N., Tikhonova, A., Gustafsson, O., Tesi, T., Martens, J., Jakobsson, M., Spasennykh, M., Semiletov, I., 2022. In-situ temperatures and thermal properties of the East Siberian Arctic shelf sediments: Key input for understanding the dynamics of subsea permafrost. <i>Marine and Petroleum Geology</i> , 138, p.105550.	Marine record	Methodological - observation	<b>ISP</b>
Corella, J. P., Maffezzoli, N., Spolaor, A., Vallelonga, P., Cuevas, C. A., Scoto, F., Müller, J., Vinther, B., Kjær, H. A., Cozzi, G., Edwards, R., Barbante, C., & Saiz-Lopez, A. (2022). Climate changes modulated the history of Arctic iodine during the Last Glacial Cycle. <i>Nature Communications</i> , 13(1), 88. <a href="https://doi.org/10.1038/s41467-021-27642-5">https://doi.org/10.1038/s41467-021-27642-5</a>	Ice core record	Quaternary	<b>ISP</b>
Cornacchia, I., Brandano, M., Agostini, S., and Munnecke, A. (2022). Neodymium isotopes of central Mediterranean phosphatic hardgrounds reveal Miocene paleoceanography. <i>Geology</i> , 50(9), 1023-1027.	Marine record	Miocene	<b>IGG</b>
Crotti, I., Quiquet, A., Landais, A., Stenni, B., Wilson, D.J., Severi, M., Mulvaney, R., Wilhelms, F., Barbante, C., Frezzotti, M., 2022. Wilkes subglacial basin ice sheet response to Southern Ocean warming during late Pleistocene interglacials, <i>Nature Communications</i> , 13, 5328, doi: 10.1038/s41467-022-32847-3.	Ice core	Quaternary	<b>Venice University ISP</b>
De Benedetti, C., Gerasimenko, N., Ravazzi C., Magri D. 2022. History of Tilia in Europe since the Eemian: Past distribution patterns. <i>Review of Palaeobotany and Palynology</i> 307, 104778 (pp. 1-15). <a href="https://doi.org/10.1016/j.revpalbo.2022.104778">https://doi.org/10.1016/j.revpalbo.2022.104778</a>	Terrestrial record	Quaternary	<b>IGAG</b>
De Santis V., Scardino G., Scicchitano G., Montagna P., Pons-Branchu E., Ortiz J., Sánchez-Palencia Y., Lisco S., Moretti M., Caldara M. (2022). Last interglacial pressure pattern over the Mediterranean from aeolian sediments: A case study from Apulia. <i>Palaeogeography, Palaeoclimatology, Palaeoecology</i> , 605, 111228.	Terrestrial record	Quaternary	<b>ISP ISMAR</b>



Dillon, E.M., Pier, J.Q., Smith, J.A., Raja, N.B., Dimitrijević, D., Austin, E.L., Cybulski, J.D., De Entrambasaguas, J., Durham, S.R., Grether, C.M., Haldar, H.S., Kocáková, K., Lin, C.-., Mazzini, I., Mychajliw, A.M., Ollendorf, A.L., Pimiento, C., Regalado Fernández, O.R., Smith, I.E. & Dietl, G.P. 2022. What is conservation paleobiology? Tracking 20 years of research and development. <i>Frontiers in Ecology and Evolution</i> , vol. 10.	conservation	Methodological - observation	<b>IGAG</b>
Ermolli, E.R., Masi, A., Vignola, C., Di Lorenzo, H., Masci, L., Bona, F., Forti, L., Lembo, G., Mazzini, I., Mecozzi, B., Muttillio, B., Pieruccini, P., Sardella, R. & Sadori, L. 2022. The pollen record from Grotta Romanelli (Apulia, Italy): New insight for the Late Pleistocene Mediterranean vegetation and plant use. <i>Review of palaeobotany and palynology</i> , vol. 297.	Terrestrial record	Holocene	<b>IGAG</b>
Fontana V., Furlanetto G., Bertuletti P., Brunetti M., Zerbe S., Pini R. (2023) - Plant distribution and modern pollen deposition across an elevation eco-gradient: the lesson learnt from a case-study in the Italian Alps. <i>The Holocene</i> , 33(3): 281-295.	Terrestrial record	Methodological - observation	<b>IGAG, ISAC</b>
Forti, L., Romano, L., Celant, A., D'Agostino, F., Di Rita, F., Jotheri, J., Magri, D., Mazzini, I., Tentori, D. & Milli, S. 2022. The paleoenvironment and depositional context of the Sumerian site of Abu Tbeirah (Nasiriyah, southern Mesopotamia, Iraq). <i>Quaternary Research (United States)</i> , vol. 110, pp. 165-183.	Terrestrial record	Quaternary	<b>IGAG</b>
Franceschi M., Xin Jin, Zhiqiang Shi, Bin Chen, Preto N., Roghi G., Dal Corso J., and Lu Han, 2022, High-resolution record of multiple organic carbon-isotope excursions in lacustrine deposits of Upper Sinemurian through Pliensbachian (Early Jurassic) from the Sichuan Basin, China. <i>GSA Bulletin</i> .	Terrestrial record	Deep geological time	<b>IGG</b>
Francesco Riminucci, Valerio Funari, Mariangela Ravaoli, Lucilla Capotondi, 2022. Trace metals accumulation on modern sediments from Po river prodelta, North Adriatic Sea. <i>Marine Pollution Bulletin</i> , vol 175 <a href="https://doi.org/10.1016/j.marpolbul.2022.113399">https://doi.org/10.1016/j.marpolbul.2022.113399</a>	Marine record	Methodological - observation	<b>ISMAR</b>
Ivy-Ochs S., Monegato G., Reitner J.M. (2022). The Alps: glacial landforms from the Last Glacial Maximum. In: Palacios D., Hughes P.D., García Ruiz J.M., de Andrés N. (Eds.) <i>European Glacial Landscapes: Maximum Extent of Glaciations</i> , Elsevier, Amsterdam, 449-460.	Terrestrial record	Quaternary	<b>IGG</b>
Ivy-Ochs S., Monegato G., Reitner J.M. (2022). The Alps: glacial landforms prior to the Last Glacial Maximum. In: Palacios D., Hughes P.D., García Ruiz J.M., de Andrés N. (Eds.) <i>European Glacial Landscapes: Maximum Extent of Glaciations</i> , Elsevier, Amsterdam, 283-293.	Terrestrial record	Quaternary	<b>IGG</b>
Kamleitner S., Ivy-Ochs S., Monegato G., Gianotti F., Akçar N., Vockenhuber C., Christl M., Synal, H.A. (2022). The Ticino-Toce glacier system (Swiss-Italian Alps) in the framework of the Alpine Last Glacial Maximum. <i>Quaternary Science Reviews</i> , 279, 107400.	Terrestrial record	Quaternary	<b>IGG</b>
Kim, D., Kim, J.H., Tesi, T., Kang, S., Nogarotto, A., Park, K., Lee, D.H., Jin, Y.K., Shin, K.H. and Nam, S.I., 2022. Changes in the burial efficiency and composition of terrestrial organic carbon along the Mackenzie Trough in the Beaufort Sea. <i>Estuarine, Coastal and Shelf Science</i> , 275, p.107997.	Marine record	Methodological - observation	<b>ISP</b>

Kustatscher E., Martin H., Roghi G. and Krings M., 2022 A whole-plant specimen of the marine macroalga Pterigophycos from the Eocene of Bolca (Veneto, N-Italy), Special volume	Marine record	Deep geological time	<b>IGG</b>
Leicher, N., Giaccio, B., Pereira, A., Nomade, S., Monaco, L., Mannella, G., ... & Wagner, B. (2022). Central Mediterranean tephrochronology between 313 and 366 ka: New insights from the Fucino palaeolake sediment succession. <i>Boreas</i> Vol. 52, pp. 240–271.	Terrestrial record	Quaternary	<b>IGAG</b>
Margaritelli, G., Lirer, F., Schroeder, K., Cloke-Hayes, A., Caruso, A., Capotondi, L. Broggy, T., Cacho, I., Sierro F.J.2022. Globorotalia truncatulinoides in the Mediterranean Basin during the Middle–Late Holocene: Bio-Chronological and Oceanographic Indicator. <i>Geosciences</i> , vol 12, n.6, pp: 2-14 . <a href="https://doi.org/10.3390/geosciences1206024">https://doi.org/10.3390/geosciences1206024</a>	Marine record	Holocene	<b>ISMAR IRPI</b>
Mazaheri-Johari M., Roghi G., Caggiati M., Kustatscher E., Ghasemi-Nejad E., Zanchi A., Gianolla P., 2022, Disentangling climate signal from tectonic forcing: the Triassic Aghdarband Basin (Turan domain, Iran), <i>Palaeogeography, Palaeoclimatology, Palaeoecology</i> 586, 2022, 110777.	Marine record	Deep geological time	<b>IGG</b>
Mazzini, I., Aiello, G., Frenzel, P. & Pint, A. 2022. Marine and marginal marine Ostracoda as proxies in geoarchaeology. <i>Marine Micropaleontology</i> , vol. 174.	Marine record	Methodological - observation	<b>IGAG</b>
Monaco, L., Leicher, N., Palladino, D. M., Arienzo, I., Marra, F., Petrelli, M., Nomade, S., Pereira, A., Sottili, G., Conticelli, S., D'Antonio M., Fabbrizio, A, Jicha, B.R., Mannella, G., Petrosino, P., Regattieri, E., Tzedakis, P.C., Wagner, B., Zanchetta, G., Giaccio, B. (2022). The Fucino 250–170 ka tephra record: New insights on peri-Tyrrhenian explosive volcanism, central mediterranean tephrochronology, and timing of the MIS 8-6 climate variability. <i>Quaternary Science Reviews</i> , 296, 107797.	Terrestrial record	Quaternary	<b>IGAG IGG</b>
Monaco, L., Palladino, D.M., Albert, P.G., Arienzo, I., Conticelli, S., Di Vito, M., Fabbrizio, A., D'Antonio, M., Isaia, R., Manning, C.J., Nomade, S., Pereira, A., Petrosino, P., Sottili, G., Sulpizio, R., Zanchetta, G. & Giaccio, B. 2022. Linking the Mediterranean MIS 5 tephra markers to Campi Flegrei (southern Italy) 109–92 ka explosive activity and refining the chronology of MIS 5c-d millennial-scale climate variability. <i>Global and Planetary Change</i> , vol. 211.	Terrestrial record	Quaternary	<b>IGAG</b>
Monegato G., Kamleitner S., Gianotti F., Martin S., Scapozza C., Ivy-Ochs S. The Toce-Ticino Ice conveyor belts during the Last Glacial Maximum. <i>AMQ</i> 119-134	Terrestrial record	Quaternary	<b>IGG</b>
Montagna P., Colin C., Frank M., Störli T., Tanhua T., Rijkenberg M., Taviani M., Schroeder K., Chiggiato J., Gao G., Dapigny A., Goldstein S. (2021). Dissolved neodymium isotopes in the Mediterranean Sea. <i>Geochimica et Cosmochimica Acta</i> , 332, 143-169.	Calibration	Methodological - observation	<b>ISP ISMAR</b>
Nowak, H., Kustatscher, E., Roghi G. and Van Konijnenburg-van Cittert, J. H. A., 2022; In situ spores of lycophytes from the Anisian Kühwiesenkopf/Monte Prà della Vacca flora in northern Italy, <i>Botany Letters</i>	Terrestrial record	Deep geological time	<b>IGG</b>
Nowak, H., Kustatscher, E., Roghi G. and Van Konijnenburg-van Cittert, J. H. A., 2023, In situ spores of marattialean ferns from the Triassic in Central and Northern Europe. <i>Review of Palaeobotany and Palynology</i> 308 (2023) 104785	Terrestrial record	Deep geological time	<b>IGG</b>

Olivetti, V., Balestrieri, M. L., Chew, D., Zurli, L., Zattin, M., Pace, D., Drakou F., Cornamusini G. & Perotti, M. (2023). Ice volume variations and provenance trends in the Oligocene-early Miocene glaciomarine sediments of the Central Ross Sea, Antarctica (DSDP Site 270). <i>Global and Planetary Change</i> , 104042.	Ice core Record	Deep geological time	<b>IGG</b>
Piccini, L., Regattieri, E., Zerboni, A., & Perçoiu, A. (2022). Cave Deposits: Processes, Approaches and Environmental Significance. <i>Frontiers in Earth Science</i> , 10, 858704.	Terrestrial record	Quaternary	<b>IGG</b>
Pieruccini, P., Forti, L., Mecozzi, B., Iannucci, A., Yu, T.-., Shen, C.-., Bona, F., Lembo, G., Mutillo, B., Sardella, R. & Mazzini, I. 2022. Stratigraphic reassessment of Grotta Romanelli sheds light on Middle-Late Pleistocene palaeoenvironments and human settling in the Mediterranean. <i>Scientific Reports</i> , vol. 12, no. 1.	Terrestrial record	Holocene	<b>IGAG</b>
Pini R., Aceti A., Poggiani Keller R., Quirino T., Ravazzi C., Ruggiero M.G., Vallè F. 2022. Ecosistemi naturali ed ecologia umana in Valcamonica a partire dall'ultima deglaciazione. Preistoria e Protostoria in Lombardia e Canton Ticino. <i>Rivista di Scienze Preistoriche - LXXII S2</i> , 37-48. ISBN 978-88-6045-056-2.	Terrestrial record	Holocene	<b>IGAG</b>
Pini R., Furlanetto G., Vallè F., Badino F., Wick L., Anselmetti F., Bertuletti P., Fusi N., Morlock M., Delmonte B., Harrison S.P., Maggi V., Ravazzi C. 2022. Linking North Atlantic and Alpine Last Glacial Maximum climates via a high-resolution pollen-based subarctic forest steppe record. <i>Quaternary Science Reviews</i> 294, 107759 (pp. 1-18). <a href="https://doi.org/10.1016/j.quascirev.2022.107759">https://doi.org/10.1016/j.quascirev.2022.107759</a>	Terrestrial record	Quaternary	<b>IGAG</b>
Ravazzi C., Artioli G., Baioni M., Banino R., Castellano L., Castelletti L., Chiesa S., Colombaroli D., Cremaschi M., Croce E., Dal Corso M., Dal Sasso G., Deaddis M., De Amicis M., Ferrario F., Fontana F., Furlanetto G., Garozzo L., Livio F., Mangani C., Marchetti M., Martinelli E., Maria Michetti A., Motella De Carlo S., Nicosia C., Perego R., Peresani M., Pini R., Poggiani R., Quirino T., Rapi M., Ravazzi C., Rottoli M., Giuseppina Ruggiero M.G., Tinner W., Tramelli A., Trentacoste A., Vallè F., Visentin D., Wick L., Zanon M., Zerboni A. 2022. Scenari di ricostruzione delle interazioni uomo-ambiente-clima in Lombardia (N-Italia) dal Paleolitico medio all'età del Ferro. Key-note. <i>Rivista di Scienze Preistoriche, Atti LII RS IIPP. LXXII S2 - 9-36</i> . ISBN 978-88-6045-056-2.	Terrestrial record	Holocene	<b>IGAG IGG</b>
Riminucci F., Funari V., Ravaioli M., Capotondi L. 2022. Trace metals accumulation on modern sediments from Po river prodelta, North Adriatic Sea. <i>Marine Pollution Bulletin</i> , vol. 175 DOI:10.1016/j.marpolbul.2022.113399	Marine record	Methodological - observation	<b>ISMAR</b>
Russo B., Ferraro L., Correggia C., Alberico I., Foresi L. M., Vallefuoco M., Lirer F. 2022. Deep-water paleoenvironmental changes based on early-middle Miocene benthic foraminifera from Malta Island (Central Mediterranean). <i>Palaeogeography, Palaeoclimatology, Palaeoecology</i> , 586, 110722.	Marine record	Deep geological time	<b>ISMAR</b>
Scoto, F., Sadatzki, H., Maffezzoli, N., Barbante, C., Gagliardi, A., Varin, C., Vallelonga, P., Gkinis, V., Dahl-Jensen, D., Kjær, H. A., Burgay, F., Saiz-Lopez, A., Stein, R., & Spolaor, A. (2022). Sea ice fluctuations in the Baffin Bay and the Labrador Sea during glacial abrupt climate changes.	Ice core record	Quaternary	<b>ISP ISAC</b>

Proceedings of the National Academy of Sciences, 119(44). <a href="https://doi.org/10.1073/pnas.2203468119">https://doi.org/10.1073/pnas.2203468119</a>			
Serandrei-Barbero, R., Donnici, S., Zecchetto, S., 2022. Past and future behavior of the valley glaciers in the Italian Alps. <i>Frontiers in Earth Science</i> , 10, 972601.	Terrestrial record	Historical-modern	<b>ISP IGG</b>
Shi, X., Werner, M., Krug, C., Brierley, C. M., Zhao, A., Igbinsosa, E., ... & Lohmann, G. (2022). Calendar effects on surface air temperature and precipitation based on model-ensemble equilibrium and transient simulations from PMIP4 and PACMEDY. <i>Climate of the Past</i> , 18(5), 1047-1070.	modelling	Historical-modern	<b>ISAC</b>
Storto, L. Cheng, C. Yang, 2022, Revisiting the 2003–18 Deep Ocean Warming through Multiplatform Analysis of the Global Energy Budget. <i>J. Climate</i>	Marine record	Historical-modern	<b>ISMAR</b>
Totaro, F., Insinga, D.D., Lirer, F., Margaritelli, G., Català i Caparrós, A., de la Fuente, M., Petrosino, P., 2022. The Late Pleistocene to Holocene tephra record of ND14Q site (southern Adriatic Sea): Traceability and preservation of Neapolitan explosive products in the marine realm. <i>Journal of Volcanology and Geothermal Research</i> 423, <a href="https://doi.org/10.1016/j.jvolgeores.2021.107461">https://doi.org/10.1016/j.jvolgeores.2021.107461</a>	Marine record	Quaternary	<b>ISMAR</b>
Trotter J., McCulloch M., D’Olivo J.P., Scott P., Tisnerat-Laborde N., Taviani M., Montagna P. (2022). Deep-water coral records of glacial and recent ocean-atmosphere dynamics from the Perth Canyon in the southeast Indian Ocean. <i>Quaternary Science Advances</i> , 6, 100052.	Marine record	Historical-modern	<b>ISP ISMAR</b>
Wild, B., Shakhova, N., Dudarev, O., Ruban, A., Kosmach, D., Tumskey, V., Tesi, T., Grimm, H., Nybom, I., Matsubara, F. and Alexanderson, H., 2022. Organic matter composition and greenhouse gas production of thawing subsea permafrost in the Laptev Sea. <i>Nature Communications</i> , 13(1), p.5057.	Marine record	Historical-modern	<b>ISP</b>
Zanchi, A., Ravazzi, C., Cavallin, A., Deaddis, M., De Amicis, M., Arosio, T., Marchetti, M. & Vezzoli, G. 2022. Interplay of Holocene surface faulting and climate in the Central Po Plain, Italy. <i>Quaternary Research (United States)</i> , vol. 107, pp. 71-86.	Terrestrial record	Holocene	<b>IGAG</b>

#### 4. ONGOING PhD THESIS

##### **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**

**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**

**Diego Marianelli** – PhD in Earth Sciences

*The Oi-1 and Mi-1 events: insights from shallow and deep carbonate successions of the central and western Mediterranean*

**DST Sapienza Università di Roma – Cotutor IGG**

### **Istituto di Scienze Polari**

**Alessio Nogarotto - PhD in Polar Sciences**

Understanding land-ocean connections and coastal sea ice dynamics in polar regions during the last 30ky through a combination of marine and terrestrial biomarkers

UNIVE Ca Foscari Tutor ISP

**Chiara Pambianco - PhD in Polar Sciences**

Understanding feedbacks to climate during the last deglaciation: reconstructions from multiproxy multi site case studies in the Ross sea

UNIVE Ca Foscari Tutor ISP

**Giuditta Celli - PhD in Polar Sciences**

The influence of the Antarctic ozone hole on geochemical cycles

UNIVE Ca Foscari Tutor ISP

**Delia Segato - PhD in Polar Sciences**

Arctic sea ice dynamics and fram strait sea ice export reconstructed from east greenland ice core archives

UNIVE Ca Foscari Tutor ISP

**Veronica Amoruso - PhD in Polar Sciences**

A snowpack module for modelling chemical exchanges (mercury, iodine, bromine) at the snow-air interface in climate model

UNIVE Ca Foscari Tutor ISP

**Giulia Genuzio - PhD in Polar Sciences**

G.A.I.A: Great Acceleration In Antarctica - An ice core high-resolution, multi-proxy approach

UNIVE Ca Foscari Tutor ISP

### **Istituto di Geologia Ambientale e Geoingegneria (IGAG)**

**Massimo Novellino – PhD in Earth Sciences**

Landscape evolution in the northern Adriatic regions in the Late Pleistocene

**Geosciences UniPD – Cotutor IGAG coll. ISMAR**

**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**

