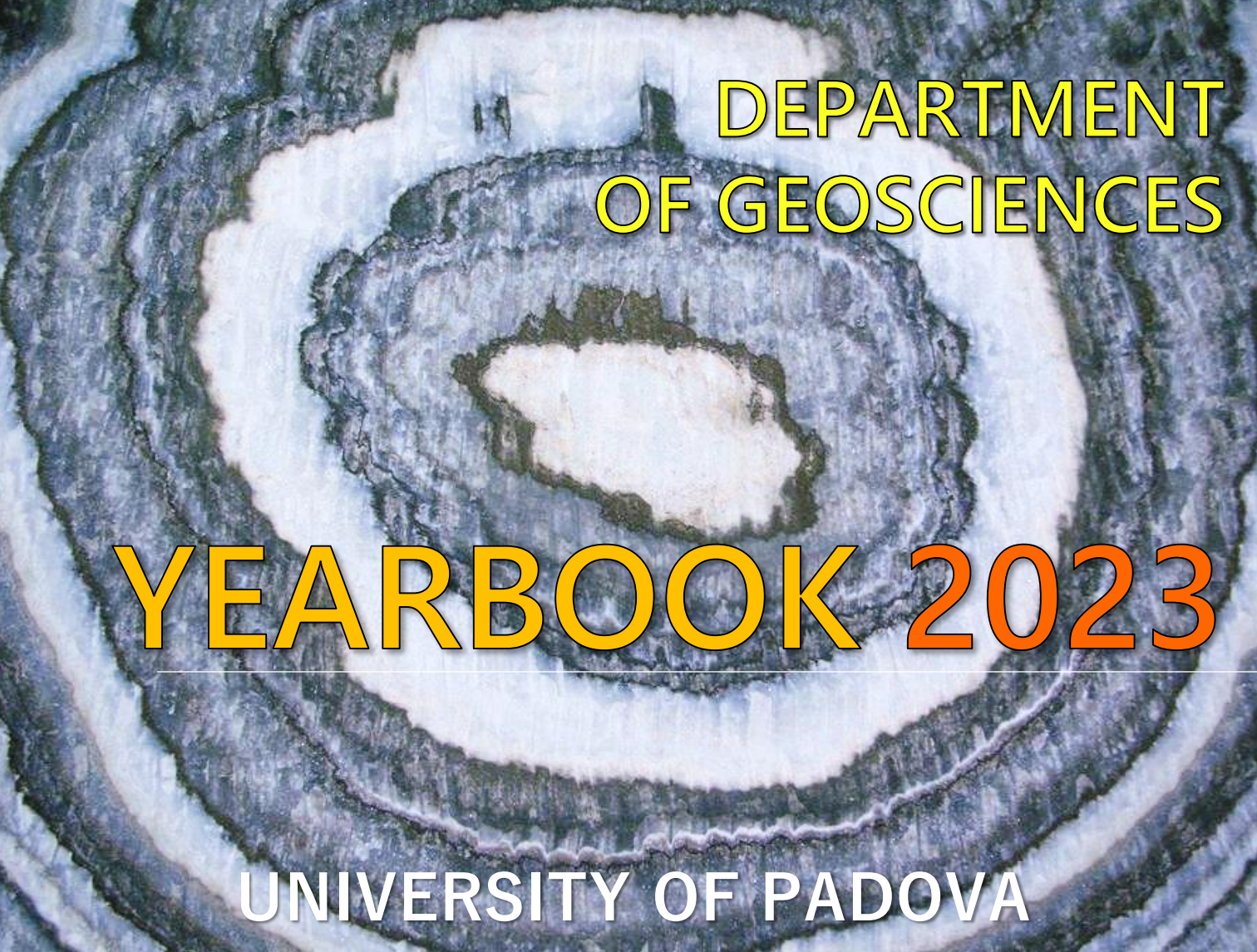

DEPARTMENT
OF GEOSCIENCES
YEARBOOK 2023
UNIVERSITY OF PADOVA

DEPARTMENT OF GEOSCIENCES

YEARBOOK 2023

UNIVERSITY OF PADOVA

A WORD FROM OUR DIRECTOR

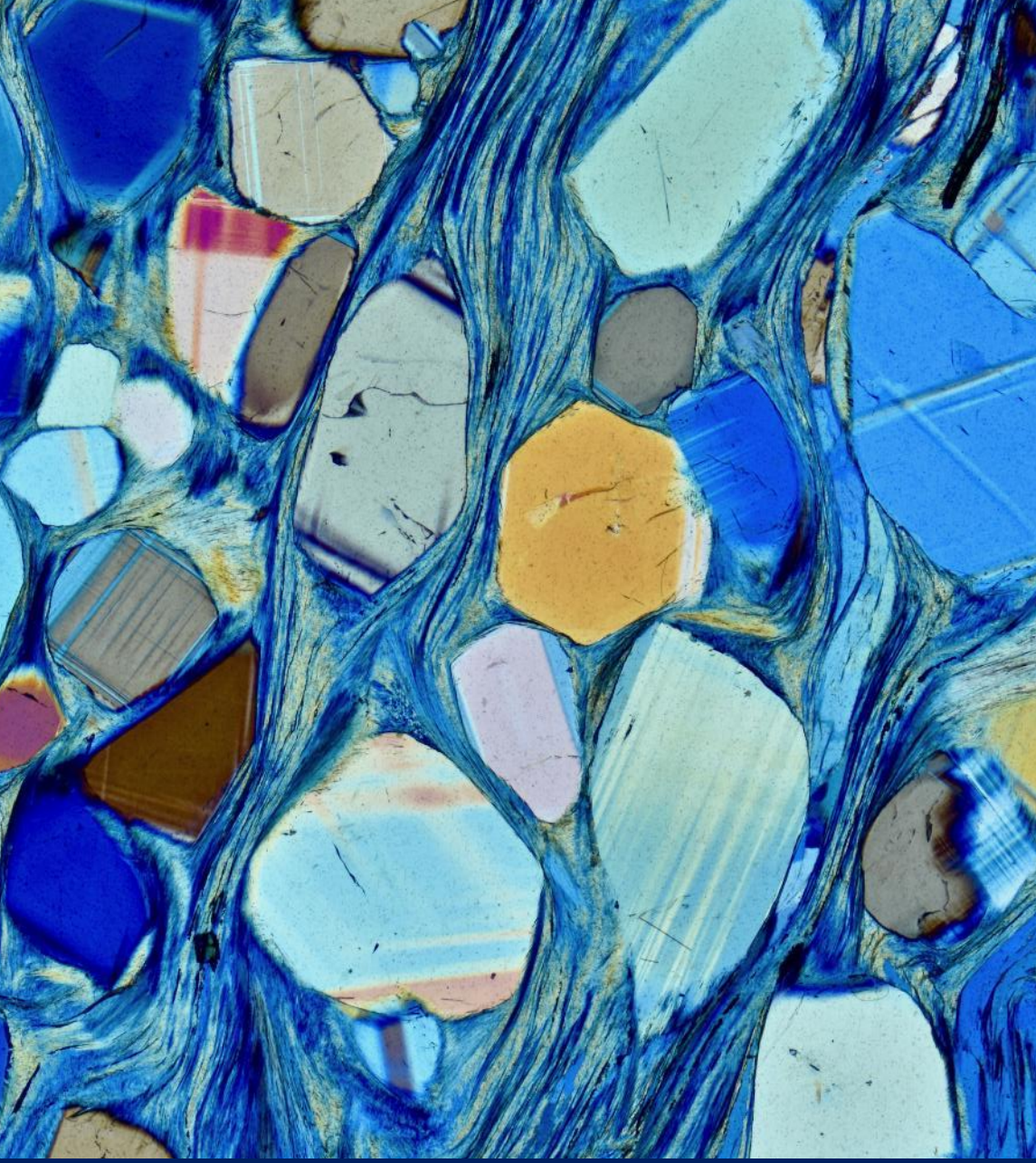
In this brief introduction to the fifth edition of the Yearbook, I would like to summarize and point out some key aspects that occurred in 2023. Let' start with some numbers about people working in the Department. We are about 235 people: 70 professors and researchers; 35 technical and administrative staff; about 130 PhD students and postdoc. Teaching activity has changed significantly over the last few years, by offering new courses and degrees. A new bachelor degree in "Earth and Climate Dynamics" started in October 2023. Overall, we are involved in 9 bachelor and 12 master degrees, and we are hosting and managing 2 BSc ("Geological Sciences" and "Earth and Climate Dynamics") and 2 MSc degrees ("Environmental Geology and Earth Dynamics" and "Geophysics for Natural Risks and Resources"). The PhD course in "Geosciences" keeps running very well, offering a large number of scholarships (21 in 2023) and attracting several students from abroad (25-35 % of the PhD students came from abroad over the last three years). What about our research activity? We performed very well in the last research assessment at national level (VQR 2015-19; results published in May 2022) and this allowed us to be funded by the Ministry of University and Research within the Excellence Projects scheme. The project "The Geosciences for Sustainable Development", which started this year and will run till 2027, aligns with the United Nations' Agenda 2030 Sustainable Development Goals and is focused on four research and teaching areas (climate change and risk mitigation; geomaterials and georesources for energy transition; water resource and soil protection and management; use of big data in Geosciences). Among the different activities of scientific dissemination, I would like to point out the opening of the "Museum of Nature and Humankind" (Museo della Natura e dell'Uomo - MNU) that that took place in June 2023. The Museum includes the former Department's collections (rocks, fossils and minerals) and other University collections of zoology and anthropology. Finally, this Yearbook, as previous editions, is very rich of information and gives a comprehensive overview of the Department activities, enjoy the reading!

Prof. Nicola Surian
Head of the Department of Geosciences

History

HISTORY *by L. Capraro*

The University of Padova played a fundamental role in promoting and advancing the development of modern Geology as we know it. Teaching of Earth Sciences at the University of Padova dates back to 1734, when A. Vallisneri Jr. bestowed to the "Magistrato dei Riformatori dello Studio di Padova" the extensive naturalist collections previously owned by his late father. In view of that, the course of study in "Storia Naturale Speciale" was established, this representing the ancestor of the modern Natural Sciences curriculum. Separation between biological (i.e., Zoology and Comparative Anatomy) and non-biological sciences occurred in 1869, when Giovanni Omboni was awarded the Chair of Mineralogy and Geology. In 1883, the geo-mineralogic collections, hitherto housed in the main building of the University (Palazzo del Bo), were further subdivided into a mineralogic and a geologic collection. The former Chair of "Storia Naturale Speciale" was accordingly converted and split into an Institute and Museum of Mineralogy (Chair Ruggero Panebianco) and an Institute and Museum of Geology (Chair Giovanni Omboni). In 1932, the mineralogic and geologic collections were moved to "Palazzo Cavalli" compound, where they are presently hosted. In the 1980s, Institutes were reformed into Departments, with further separations between the former institutions. At that time, Geosciences at Padova were structured into three separate Departments: the Department of Mineralogy and Petrology and the Department of Geology, Paleontology and Geophysics, both located at Palazzo Cavalli, and the Department of Geography, which was hosted in a separate building. In 2007, the Departments housed at Palazzo Cavalli merged into the Department of Geosciences, which is nowadays located in a building launched in late 2010. Since 2012, the Department also includes Physical Geographers previously afferent to the Department of Geography.



Management

NICOLA SURIAN
Head of the Department

PAOLO NIMIS
Vice-Head of the Department

SILVIA BORTOLAMI
Head of the Administrative Staff

CLAUDIA AGNINI
Coordinator of the PhD Programme

PAOLO MOZZI
Coordinator of first cycle degrees in Geological Sciences, and second cycle degree in Geology and Technical Geology

GIORGIO CASSIANI
Coordinator of the second cycle degree in Geophysics for Natural Risks and Resources

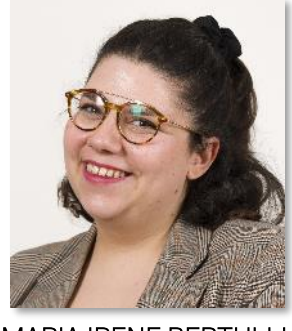
FABRIZIO NESTOLA
Coordinator of the Bachelor Degree in Earth and Climate Dynamics

Technical and administrative staff

ADMINISTRATION AND GENERAL SERVICES

SILVIA BORTOLAMI
Head of the Administrative staff

KATIA BELCARO



MARIA IRENE BERTULLI

LAURA CORAIN

CRISTIAN IOZZIA

GIADA MIOTTO FASCINA

MICHELA NORDIO

AMABILE PELOI

MICHELA SINIGAGLIA

SERVICES TO TEACHING, POST-LAUREAM, RESEARCH AND OUTREACH

ELISA FACCIOLO
Service Coordinator

SONIA CASSARA'

ANNA DI MURO

PIERSAVINO LICHINCHI

BARBARA PAKNAZAR

CRISTINA TOSATO

SARA VETTORE

TECHNICAL AND IT SERVICES

MARIA ORNELLA ROSSIN
Service coordinator

DARIO ANNUNZIATA

BRUNO CIERVO

ALBERTO DE LORENZI

NICOLA PRATICELLI

ANTONELLA RASSU *
* Photo not published on request of the employee

LABORATORIES AND SPECIALIZED SERVICES

LEONARDO TAURO
Service coordinator

CATERINA CANOVARO

CARLOTTA BETTO

STEFANO CASTELLI

SILVIA CATTO'

MARCO FAVERO

GIAMPAOLO GIRARDI

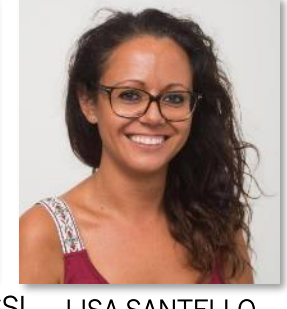
NICOLA MICHELON

JACOPO NAVA

DARIA PASQUAL

GIULIA RICCI

ROBERTO MARIA ROSSI



LISA SANTELLO

FRANCESCO SARTOR

Full Professors

CLAUDIA AGNINI
My research field is micropaleontology and I particularly focus on the study of calcareous nannofossils both as biostratigraphic and paleoceanographic tools.

GILBERTO ARTIOLI
My research interests are: the materials science of alternative and green building materials; Reuse and recycle of industrial materials for circular economy; solidification and stabilization of contaminated soils; the materials science of cultural heritage.

GIORGIO CASSIANI
My research interests are: Geophysical methods for environmental applications; Seismological micro-scale zoning and other soil dynamics uses of exploration geophysics; Integration of hydrological modeling with geophysical methods; Geomechanics for environmental applications.

FILIPPO CATANI
My research interests are: landslide hazard, machine learning applied to geohazards, surface processes monitoring and modelling, applications of remote sensing to landslide studies, oil & gas environmental impact and risk, surface monitoring in open-pit mines, scaling processes.

BERNARDO CESARE
I work on metamorphic petrology, with special interest for: High-grade metamorphism and partial melting of pelitic rocks; Origin of Granites; Fluid and melt inclusions; Petrologic mineralogy.

FRANCESCA DA PORTO
My research interests are: Seismic vulnerability; Analysis, intervention and monitoring of historic and modern masonry buildings, RC structures and bridges; Development of procedures for large scale assessment of seismic risk.

ANDREA D'ALPAOS
I am a hydraulic engineer who studies the biomorphodynamic evolution of coastal and fluvial landscapes in response to climate change and human pressure, through field observations, laboratory experiments, and mathematical modeling.

SILVANA MARTIN
My research interests are: Structural setting of the Alps; Geodynamics of subduction zones; Paleoseismogenic faults and material, Monitoring and dating alpine rock avalanches and landslides

CRISTIANO NICOSIA
I am a geoarchaeologist who studies Bronze Age domestic contexts and that analyzes the sediments in and around archaeological sites to reconstruct the anthropic impact on the paleo-environment.

GIULIO DI TORO
I investigate earthquake physics and faulting by integrating: Field studies of seismogenic fault zones; Rock deformation experiments; Microstructural/geochemical investigations of natural and experimental fault zone products.

FABRIZIO NESTOLA
My research interests are: Mineralogy under extreme conditions of pressure and temperature; Geothermobarometry of diamond-inclusion systems; Carbon phases in meteorites.

PAOLO NIMIS
My research fields are: Thermobarometry and geochemistry of mantle rocks and diamonds; Mafic-ultramafic-hosted seafloor massive sulfide deposits; Alpine copper metallogeny and provenancing.

GIORGIO PENNACCHIONI
My research interests are: Exhumed paleoseismic (pseudotachylyte-bearing faults); Nucleation and localization in ductile shear zones; Microstructures in mylonitic zones; Fluid-rock interaction in the ductile field.

CRISTINA STEFANI
My research interests are composition and provenance of terrigenous sediments (sand composition and transparent heavy mineral associations) in different geological contexts for paleogeographic and paleoclimatic reconstructions.

NICOLA SURIAN
My research interests are: Geomorphic response to extreme flood events and assessment of flood hazard; Sediment dynamics and estimate of bedload transport in large gravel-bed rivers; Channel adjustments and their evolutionary trajectory and prediction of future scenarios.

MASSIMILIANO ZATTIN
My research interests are: Applications of thermochronology to tectonic evolution of orogenic chains, basin analysis, provenance studies and paleogeographic reconstructions; Feedbacks between tectonics, erosion, sedimentation and climatic variations.

Associate Professors

OMAR BARTOLI
My research interests are: High temperature metamorphism; Crustal melting and granite formation; Melt inclusions in magmatic and metamorphic rocks; P-T-t evolution of high-grade metamorphic terranes; Volatiles in crustal magmas.

JACOPO BOAGA
I'm an applied geophysicist. My research interests concern mainly engineering and environmental geophysics such as geophysics for natural hazard scenarios, electrical and electro-mag.

ANNA BREDA
My research focuses on facies analysis and sequence stratigraphy of clastic and mixed sedimentary successions of continental to shallow-marine environments in terms of depositional processes and stratigraphic architecture.

SIMONE BIZZI
Fluvial Geomorphology in particular: the use of emerging remote sensing technology to develop model of sediment transport, sediment connectivity and fluvial processes in general. The use of this knowledge to support river management.

LAPO BOSCHI
I study how waves propagate in complex media and apply this knowledge to a number of different fields of research, within the general domains of acoustics and seismology. I am interested in wave-based imaging in geology; sound localization in acoustics; acoustic display.

LUCA CAPRARO
My research focuses on reconstructing the stratigraphy and climatic evolution of the Central Mediterranean during the Pliocene and Pleistocene based on the study of onland marine sediments from Southern Italy.

MARIA CHIARA DALCONI
My research activity focuses on mineralogy applied to the study of industrial materials and their impact on the environment. I mainly use powder diffraction technique to characterize raw materials, industrial materials and their by-products and wastes.

MANUELE FACCENDA
I am a solid earth geophysicist working on numerical simulations of plate tectonics and mantle convection processes. I aim at improving our understanding of the Earth's dynamics by reproducing the complex interplay of different geological processes.

ALESSANDRO FONTANA
I am a geomorphologist and Quaternary geologist with interest in the evolution of the alluvial and coastal environments and in the geoarchaeological aspects.

PAOLO FABBRI
My research field includes: Geostatistics in hydrogeology; Hydrogeology of geothermal areas; Hydrogeological parameterization of aquifers.

MARIO FLORIS
My research field includes: Probabilistic and deterministic modeling of rainfall-induced landslides; GIS-based landslide hazard analysis; Remote sensing techniques in landslide identification and characterization; A-DInSAR techniques for subsidence and landslide analyses.
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ELIANA FORNACIARI
My research interests are upper Cretaceous-Cenozoic calcareous nannofossil biostratigraphy, biochronology and paleoecology with special reference to tempo and mode of the extinction/recovery pattern of nannofossils during environmental perturbations.

ANTONIO GALGARO
My research interests are: Geothermics; Artificial Intelligence; Machine learning; Landslides risk, early warning and monitoring.

LUCA GIUSBERTI
I study foraminifera as tools for investigating the climatic variability in the Cretaceous and Paleogene. Secondarily, I am currently working on several aspects of Italian Cretaceous and Paleogene Fossil-Lagerstätte.

MATTEO MASSIRONI
My research interests are: Exploration and geology of planetary surfaces and small bodies of the Solar System; Geological mapping including Remote Sensing, GIS and 3D modelling; Fault architectures and regional tectonics.

MASSIMILIANO GHINASSI
I am a clastic sedimentologist working mainly on alluvial and coastal deposits. I aim at improving models to interpret the sedimentary record by linking sedimentary products with modern processes and experiments.

LARA MARITAN
I work on minero-petrographic application to cultural heritage materials and sites, archaeometry, new mix design for sustainable brick production.

CLAUDIO MAZZOLI
Petrography applied to archeological materials, and stone deterioration. New building materials using industrial waste. Petrography and geochemistry of carbonates in paleoclimate studies. Radon risk. Metamorphic petrology and monazite geochronology.

STEFANO MONARI
I focus on all aspects of paleontology of Mesozoic bivalves and gastropods, including systematics, phylogenetic analysis, stratigraphical significance, paleoecology and paleobiogeography.
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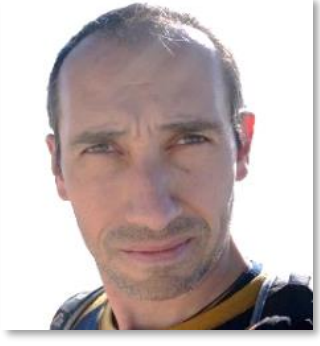
PAOLO MOZZI
My research fields are: Geomorphology; Quaternary geology; geoarchaeology; palaeopedology; alluvial, glacial and lagoon landforms and deposits; geomorphological mapping; mapping of Quaternary deposits.



VALERIO OLIVETTI
My main research interests are tectonics, orogenic processes, quantification of erosion, thermochronology.

DAVIDE NOVELLA
I am an experimental geochemist studying global geochemical cycles (particularly of volatile elements and stable isotopes) to understand the evolution of the solid Earth via magmatic processes.

MARTHA PAMATO
I study unique samples forming in the deep Earth, such as inclusions in diamond. I also conduct experiments to determine the properties of mantle minerals. My research goal is to understand the structure, composition and evolution of the Earth.

LEONARDO PICCININI
My research focuses on applied geology and hydrogeology.

NEREO PRETO
My research fields are: Stratigraphy, sedimentology and cyclostratigraphy of carbonate platforms; isotopic geochemistry; petrology and diagenesis of carbonates aimed at paleoclimatic reconstructions and modelling the depositional architecture of carbonate platforms.

GABRIELLA SALVIULO
Application of iron oxide nanoparticles for waters and soils remediation from heavy metals and the role of soils mineralogical composition in the pollutants release. Relationships between mineralogy, sustainability human rights.

PAOLO SCOTTON
My research focuses on: Debris Flows; Snow avalanches; Geothermal heat exchange.

MANUEL RIGO
My cross-disciplinary research aims to decipher the evolution of the Earth, evaluating the role of the oceanic processes in the global climate and environmental changes on modern and geological timescales.

RAFFAELE SASSI
My research fields are: Petrology; tectono-metamorphic evolution of crystalline basements; crystal chemistry of micas; Cultural Heritage materials; radon occurrence vs. geology s.l..

ALBERTA SILVESTRI
My research activity focuses on archaeometric studies of ancient glass (vessels, mosaic tesserae, stained glass and glazes), aiming at identifying raw materials, production technologies and alteration processes.

RICHARD SPIESS
Understanding the significance of microstructures within terrestrial and extraterrestrial rocks. Study of microstructures within experimentally formed and deformed rock analogues. Metamorphic petrology. Geodynamics. Microstructures in all materials.

LUCA VALENTINI
I work on design, characterization and modelling of sustainable building materials based on clay and industrial waste.

TELEMACO TESEI
My research interests are: Structural geology of faults and shear zones; Experimental rock mechanics and earthquake mechanics; Microtectonics.

Assistant Professors

ROBERTO GATTO
All aspects of paleontology of Mesozoic and Cenozoic benthic molluscs, especially gastropods, including systematics, paleoecology, paleobiogeography and evolution.

CHRISTINE MEYZEN *
Tectonic, magmatic, and hydrothermal processes at mid-ocean ridges. Composition, evolution and dynamic of the earth's mantle. Formation of the oceanic lithosphere and crustal evolution at ridges.

* Photo not published on request of the employee

RTDa

ILARIA BARONE
The focus of my research are seismic waves, in particular surface waves, to derive information about the deep to shallow structures of the subsurface.

ANDREA BRENNA
I am a fluvial geomorphologist. My research interests focus on sediment dynamics in gravel-bed rivers, and responses of mountain streams to high-magnitude hydrological events.

MARCO DONA'
Passive control of structures and building contents by seismic isolation and energy dissipation.
Seismic behavior of structural and non-structural masonry elements. Seismic vulnerability and risk of structures and infrastructures.

BRUNA BORGES-CARVALHO
My research interests are: Anatexis at high to ultra-high temperature and ultra-high pressure conditions; Melt and fluid inclusions in peritectic garnet; Volatile contents of granitic magmas; Fluid regime of the deep crust.

CHIARA COLETTI
My main research interests are: Cultural Heritage decay and climate change; Green solutions for new mix design recycling waste; Radon occurrence in soils, rocks, and construction materials.

MICHELE FONDRIEST
I am a structural geologist and my research interests are: the internal structure and mechanics of seismogenic fault zones; rock deformation and fluid-rock interaction experiments; near-surface geophysics in fault zones.

SANSAR RAJ MEENA
My research interests are in using Remote Sensing and Geographic Information Systems for natural hazard and risk assessment with the focus on landslide problems, especially in the use of spatial information for landslide detection and hazard assessment.

PERUZZO LUCA

RICCARDO POZZOBON
My research focuses on planetary geology and structural geology. The main topics are 3D geo-modeling of planetary surface/subsurface, structures related to diapirism, mud volcanism and lava tubes and planetary analogues.

GIACOMO VINCI
The general goal of my research is to understand the evolution of landscapes through time and the interplay between human and the environment in the past.

RTDb

ALVISE FINOTELLO
Alvise's research interest focuses on the study of how the complex interactions between water, sediment, vegetation, anthropogenic pressures, and other environmental factors control the evolution of fluvial and coastal landscapes.

PIERO POLI
I am an observational seismologist working with data to understand how earthquakes starts and characterize the structure of the Earth.

ASCANIO ROSI
My research interests are landslide hazard and risk assessment from local scale to wide areas; Artificial intelligence applied to landslide hazard forecasting; remote sensing, surface processes mapping, monitoring, and modelling.

FRANCESCO MARRA
I'm interested in the interface between atmospheric processes, climate/global change, hydrology, and geomorphology, with a a special focus on hydro-meteorological extremes and related hazards approached with advanced statistical methods.

VALENTINA PRIGIOBBE
I am a geosystems and process engineer with expertise in particulate processes, and flow and transport through reactive porous media. I study complex bio-geochemical systems with modeling and experiments.

Post-Docs

LUCA BADIN
Development of a platform for the evaluation of risk due to earthquakes, floods and other natural hazards, and of related tools and procedures.

ELENA BELLIZIA
My research focuses on the morphological and sedimentological characteristics of meandering rivers, particularly the mechanisms of evolution and avulsion of Holocene channel belts in coastal plains.

ELISA BOZZOLAN
My research focuses on identifying new tools and indicators that can better explain how rivers evolve in space and time. With that aim, we are now combining satellite images and physically-based models to track changes in the morphology of the Po river.

FRANCESCO BREGLIA
My main interest research is in archaeobotany, particularly in the study of plant macro remains within archaeological sites in order to reconstruct paleoenvironment and human-environment interaction during prehistory and protohistory.

DAVIDE CAPPELLARI
My research is focused on the hydrogeology of the Venetian Plain and on the sustainability of groundwater resources, evaluated through numerical modeling.

PIETRO CARPANESE

BRUNO CASAROTTO
I wallow in GIScience, mainly doing hyperspectral image analysis and remote sensing in the terrestrial environment, peppered with drone and tripod field trips, and all their pre and post processing.

VERONICA CHIARINI
My work is mainly focused on geological mapping of alluvial plains and karst areas (CARG Project). My current research interests concern the quaternary evolution of the Friulian plain, karst landscape evolution, and the investigation of palaeoclimate signals recorded in speleothems.

RITA CHIRICO
Multiscale hyperspectral and multispectral remote sensing for Earth and Planetary Sciences: from laboratory-based to spaceborne, with integration of traditional petrographic, mineralogical and geochemical techniques.

MARTA DAL CORSO
My research interests concern the interaction of people with plants in the past, with a focus on prehistoric Europe. Palynology and phytolith analysis are applied to reconstruct vegetation history and different plant uses by human communities.

ILARIA MARIA D'ANGELI
I am a speleologist and geomophologist with main expertise in the field of hypogene cave systems.
I focused on the study of sulfuric acid caves of Italy.
Currently I'm working on the synthesis of titanate nanotubes with the aim of use them in environmental remediation.

MAXWELL DAY
I am interested in different forms of nitrogen and hydrogen impurities in diamond and what they can tell us about the processes associated with diamond formation and growth.

ISOLINA DIAZ RAMOS
My research interest are on architectural finishes conservation, building heritage, historic urban landscapes, colour, historical use of pigments, composition of mortars and the texture of renderings

JADE HANNAH WEBB EYLES

WEI FENG

VERONICA FOLLADOR
My research field focuses on seismic vulnerability and large-scale risk assessment of masonry residential buildings and churches.

SARA FRANZÈ
Enhanced closed-loop underground thermal energy storage systems, using experimental materials via numerical modelling and laboratory analysis

LUIGI GERMINARIO
My research interest is in heritage science, in particular stone weathering in monuments, historical buildings, underwater sites, and caves.

DAVIDE MARGARITORA

NICOLA NOCENTINI

GIACOMO POLETTO

ALICE PUPPIN
My research focuses on coastal ecomorphodynamics, specifically investigating the dynamics of Soil Organic Matter and Blue Carbon, and their impact on the resilience of coastal ecosystems.

ELISA SALER
My research field focuses on seismic vulnerability assessment at large scale of masonry and r.c. school buildings, for the evaluation of seismic risk and damage scenarios.

GAIA SARTORI

PAWEL MIKAL SLUPSKI
Investigation of mechanical and petrological processes during Laser Drilling of rocks for Geothermal applications

GIOVANNI TOFFOL
Interaction between coseismic brittle deformation and ductile flow in the lithosphere

ROBERTO TONUCCI
Implementation of a hydrogeological numerical model of Venetian plain, starting from a dataset made up of the data collected from boreholes in Veneto region.

BRANDON VANDERBEEK
My research focuses on improving seismic imaging strategies to better constrain the anisotropic structure of Earth's interior.

CAMILLA VIDI
Investigation of Upper Cretaceous sequences in Southern Morocco to reconstruct paleoclimates and environments.

ENRICO ZAMPIERI
Geophysical analysis of thermal effects on different types of rocks due to the combined action of laser and rapid cooling together with geothermal modeling of deep U-heat exchangers.

PhD students

AHMED ABDULGHANY ABDULLAH ABUALNOUR
V. Prigiobbe
Integration of CO_2 mineralization with mining.

SILVIA ALDRIGHETTI
G. Di Toro, G. Pennacchioni, P. Baccheschi
Mechanism of formation of tectonic "giant pseudotachylytes".

MATTIA AZZALIN
A. Fontana, A.M. Mercuri, T. Donders
Ancient human impact on environmental and geomorphic dynamics of the transitional environments.

MAELA BALDAN
C. Nicosia, D. Battistel
Analysis of biomarkers from pre-protohistoric archaeological contexts by means of Separation Techniques coupled with Mass Spectrometry.

SOFIA BRESSAN
G. Cassiani, A. Brovelli
Understanding of the triggering mechanisms of induced earthquakes in medium and high enthalpy geothermal power plants using numerical modelling.

SERENA CACCIARI
G. Pennacchioni, E. Cannaò, M. Sgambelluri
Deformation mechanisms at intermediate depths in subduction zones: the rock record of earthquakes and slow earthquakes.

DAVIDE CONEDERA
S. Monari, R. Gatto, M. Tintori
The Triassic faunal recovery in the Dolomites (Southern Alps, Italy).

YINGBO DONG
F. Catani, M. Floris
Novel approaches for the use of advanced INSAR time-series analysis in assessing and forecasting ground displacements.

MARGHERITA FABRIS
F. Da Porto
Analysis, digitalisation and intervention on urban aggregates to revamp historical centres and villages (ADIACENT).

MIKAELA KRONA
B. Cesare, O. Bartoli, B. Carvalho
Carbon cycling in the anatectic deep crust.

OLGA NESTEROVA
S. Barone, G. Cassiani. A. Brovelli
Densely distributed sensor networks for seismic wave detection in complex environments for civil engineering applications.

LEONARDO SALVADORI
T.Tesei
Slow slip mechanisms in the seismogenic zone.

JUNAID KHAN
M. Floris, A. Rosi
Improved INSAR techniques for artificial intelligence-based modelling and prediction of ground deformation.

VICTOR KIPTOO MUTAI
L.Valentini, J. Mwiti Marangu
Data science and life cycle analysis of sustainable cementitious materials in sub-Saharan Africa.

EDUARDO NOVAIS RODRIGUES
F. Nestola, G. Pearson, S.Timmerman
Origin, depth, and age of super-deep diamonds.

SAHANSILA SHRESTHA
S. Bizzi, E. Bozzolan, F. Pianosi
Increasing the reliability of simulations of sediment connectivity and transport in river networks.

VENISSE NOLWEN
G. Di Toro, Gabriel, M. Fondriest
Formation of fault damage zones in carbonates and their link with the seismic cycle.

MAURO VERONESE
G. Artioli
Natural forgeries: falsification techniques of museum specimens (fossils and minerals).

RAJESHWARI BHOOKYA
M. Floris
Assessing the impact of the climate change on landslides in the alpine environment.

PIETRO CALZONI
L. Giusberti, G. Carnevale
Fish fauna paleobiodiversity during the early Paleogene greenhouse world: the Fossil-Lagerstätten record of northeastern Italy.

NICOLE COSTA
M. Massironi
Integrating spectral, radar data and 3D modelling to investigate the stratigraphy of the Martian Polar Caps.

GIANMARIO DEL PICCOLO
M. Faccenda
Exploration of innovative methods for the inversion of seismological data and their optimization for seismic tomography models.

FEDERICA BUBOLA
C. Mazzoli, E. Balliana, C. Coletti
Diagnostic study and assessment of the conservation state of the plaster replicas of the Colonna Traiana located in the Museo della Civiltà Romana (Rome).

MARCO CERESARA
F. Da Porto
Multi-risk analysis and loss estimation for industrial assets at a territorial scale.

MOHAMMAN DAN AZIMI
A. Galgaro, E. Di Sipio, M. Procesi
Investigation of feasibility and performance of innovative dual function closed-loop heat exchange system in critical geological environments.

FILIPPO DISCONZI
G. Artioli
Physico-chemical properties and reactivity of silicate melts by thermodynamic modelling. Implementation for valorization and engineering of steel slags.

JOSEPH PATRICK DZOH FONKOU
G. Salviulo, M.C. Lavagnolo
Chemical, physical, structural and morphological characterization of recycled materials to promote the circular economy in Italian manufacturing (CPSMR).

MARCO GASPARI
F. Da Porto
Seismic risk assessment of building classes.

FATEMEH ISANIA
A. Galgaro, E. Di Sipio
Underground thermal energy storage: new solutions and sustainability.

ALESSANDRO FONTANARI
G. Artioli
Ceramic manufacturing process optimization and recovery of waste materials.

RICCARDO GUIDA
G. Artioli
Use of the mineralized phase in cements: mechanisms of interaction between the components and the long-term cement and alternative uses to SCM.

CHIARA LUCARELLI
G. Artioli
Archaeometric investigations on Bronze Age metal artifacts from Southern Italy.

MARIA EMANUELA MASCARO
L. Maritan
Lying on the seabed: modelling post-depositional alteration of pottery in marine environments.

NICOLA MOLON
F. Da Porto
Optimization of SHM system for infrastructural safety.

MICHOL RAMPADO
F. Da Porto
My research field focuses on seismic vulnerability assessment of churches through multiscale modelling approaches.

LEIDY CAROLINA SANDOVAL ESPINEL
M. Zattin
Thermotectonic history of the southernmost northern Andes.

FRANCESCA UGUAGLIATI
M. Ghinassi
Microplastics in rivers: from depositional processes to the Anthropocene stratigraphic record.

WEI-HSIN WU
G. Di Toro
Experimental studies of fluid-rock interaction and seismic cycle in geothermal fields.

BEATRICE BASCHETTI
M. Massironi, C. Carli, F.Altieri
Understanding the Noachian-Hesperian transition in the area of Meridiani Planum, Mars: a stratigraphic, compositional and morphological study

TEGAN BLOUNT
A. D'Alpaos, S. Silvestri, M. Marani
Salt marsh and seagrass meadow dynamics: sediment origin and carbon sequestration capacity

MIRIANA CHINELLO
G. Di Toro, E. Spagnuolo, T. Tesei
Formation of polished surfaces in natural rocks: experimental and field constraints

MARINA FACCI
A. Galgaro, P. Marchetti
Deep Closed Loop Geothermal Heat Exchanger and Energy Transition by O&G Wells Reuse

KUSHANAV BHUYAN
M. Floris, C. Van Westen, F. Catani
Advancing landslide inventorying through automated mapping, classification, and volume assessments

AMEDEO CAPRINO
F. Da Porto, M. Floris
Integrated monitoring and modelling approaches for better assessment of structural response to natural hazard

ANDREA CURTOLO
D. Novella
The distribution of volatile elements in the Earth's mantle

SEBASTIAN GRANADOS
N. Surian
Fluvial processes and flood hazard in humid tropical catchments of Costa Rica

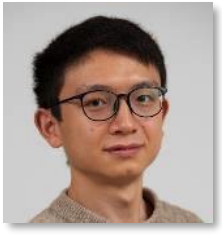
XIAOQIN JIAO
M. Zattin, V. Olivetti, J. Wang
Single-grain multi-technique dating of sediments: a new approach to study the uplift and exhumation of the northeastern Tibetan Plateau

RICCARDO MAITAN
M. Ghinassi
Peak-discharge variability in meandering rivers: linking morphodynamics to sedimentary products

ALESSANDRO MICHIELOTTO
A. D'Alpaos
Management strategies for coastal ecosystems in the face of climate change and increasing human pressure

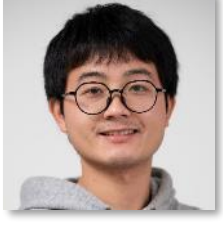
SARA MOZZON
F. Da Porto, A. D'Alpaos
Assessment and mitigation of climate change impact on urban systems

LORENZO NAVA
F. Catani, E.M. Monserrat
Improving multi-scale landslide forecasting with machine intelligence.



JUN REN
M. Faccenda, D. Novella
Mantle metasomatism and devolatilization from coupled thermo-mechanical and petrological simulations

FEDERICA VANZANI
A. Fontana, P. Mozzi
Remote sensing in the geomorphological and geoarchaeological study of alluvial plains



QIANGWANG WU
M. Rigo
Upper Triassic conodont biostratigraphy and phylogeny in the Tethyan realm

ELENA ZANOLA
L. Capraro, P. Ferretti, A. Di Stefano
Timing, mode and tempo of the major climatic transitions of the Early Pleistocene: a central Mediterranean perspective

ELEONORA BENÀ
R. Sassi, G. Ciotoli, E. Spagnuolo
Tectonic control on enhanced geogenic radon as a first order factor in radon hazard assessment

LINDSAY CAPITO
S. Bizzi, N. Surian
Geomorphic responses to sediment connectivity at the river network scale

MARIA ELENA GASTALDELLO
C. Agnini, L. Alegret
The latest Miocene-early Pliocene biogenic bloom: duration, causes and paleoceanographic implications

MASSIMO DOMENICO NOVELLINO
A. Fontana, C. Ravazzi
Landscape evolution in northern Adriatic regions in the late Pleistocene

MIRKO PAVONI
J. Boaga
Electrical and electromagnetic geophysical surveys in rock glacier environments

SILVIA PULIERO
M. Floris, F. Catani
Detection and monitoring of slope instabilities through satellite SAR data in areas affected by extreme climate events

LUKAS RETTIG
P. Mozzi, G. Monegato, M. Spagnolo
The equilibrium line altitude (ELA) in the southern fringe of the Alps during the Last Glacial Maximum

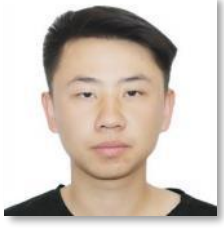
MICHELA SIMONATO
E. Fornaciari, S. Gardin, L. Giusberti
Calcareous nannofossil evolution during upper Cretaceous paleoenvironmental stress. Testing the impact of oceanic anoxic event (OAE2) and the Late Turonian Events on the synchronism of biohorizons

ANDREA BOSCAINI
A. Marzoli, N. Preto, J. Davis
Geochronology, geochemistry, and modelling of large magmatic events and global climate changes

GIANLUCA CADELANO
A. Galgaro, A. Bernardi, G. Dalla Santa
Innovative solutions for ground heat exchangers

PIETRO CARPANESE
F. da Porto
Seismic risk assessment on a territorial scale based on bayesian approaches and machine learning

OLIVER CHRIST
F. Nestola, F.E. Brenker
Extraterrestrial diamonds in ureilites and meteorites



WEI FENG
G. Di Toro
Investigation of seismic slip in experimental faults under hydrothermal conditions

YIKAI LIU
G. Artioli, L. Valentini, M. Dalconi
Studies on the ionic transports in soil-binder systems
.

LUDOVICO MASCARIN
L. Valentini
Classical and alternative cement binders: New Approaches to investigate the reaction kinetics

SIMONE MASOCH
G. Di Toro, J. Cembrano, G. Pennacchioni
Structure, evolution and deformation mechanisms of large displacement seismogenic faults in the continental crust

ALICE PUPPIN
A. D'Alpaos, M. Marani
Marsh biomorphodynamics under natural and anthropogenic changes through field observations and their modelling interpretation

.

PAWEL MICHAL SLUPSKI
B. Cesare, O. Bartoli, J. Majka
Former melt inclusions from (U)HP gneisses of the Scandinavian Caledonides

ILARIA TOMASI
M. Massironi, C. Meyzen, F. Sauro
Formation processes and evolution of large size lava tubes

APSARA SHARMA DHAKAL
L. Boschi, I. Molinari
Constraining the source of earthquake using time reversal seismic data

TOFFOL GIOVANNI
G. Pennacchioni, L. Menegon, A. Camacho
Interaction between coseismic brittle deformation and ductile flow in the lithosphere

ALBERTO ZONTA
F. da Porto
Development of seismic isolation systems for industrial racks

Our commitment
beyond the Department

INQUA (International Union for Quaternary Research)	Member of board of TERPRO Commission (Terrestrial Processes, Deposits & History)	Alessandro Fontana
National Science Center, Poland	Project evaluator	Bernardo Cesare
University of Otago's Staffing Advisory Committee	Referee	Bernardo Cesare
Indian Institute of Technology Kanpur, India	Evaluator	Bernardo Cesare
ICS	ISPS Secretary	Claudia Agnini
UNIPD	Member of the Council of the Faculty of Science	Claudia Agnini
WING (Women in Geothermal)	Italy Country Ambassador	Eloisa Di Sipio
Unione Geotermica Italiana	Responsabile scientifico Polo Nord Est	Eloisa Di Sipio
University of Padova	Member of the Academic Senate	Fabrizio Nestola
University of Padova	Board member of the Scuola Galileiana di Studi Superiori	Fabrizio Nestola
European Research Council	Member of the ERC Consolidator PE10 evaluation panel	Fabrizio Nestola
Istituto Veneto di Scienze, Lettere ed Arti	Member	Fabrizio Nestola
Accademia delle Scienze di Torino	Member	Fabrizio Nestola
Accademia Nazionale delle Scienze	Member	Fabrizio Nestola
UNESCO Chair on Prevention and Sustainable Management of Geo-hydrological Hazards	Chair associate	Filippo Catani
Centro di Protezione Civile dell'Università di Firenze	Member of the Scientific Board	Filippo Catani
International Association of Engineering Geology (Italian Branch)	Member of the Scientific Council	Filippo Catani
Consiglio Nazionale delle Ricerche	Member - DPCNR 26/2019 - Committee for studying and drafting technical standards for constructions	Francesca da Porto
European Association for Earthquake Engineering	Chair - EAEE-WG10 "Seismic aspects of monuments preservation"	Francesca da Porto
UNI - Ente Italiano di Normazione	Member - UNI/CT 021/GL 08 (U730006) Structural Engineering Committee/Working Group 6 "Monitoring of structures"	Francesca da Porto
UNI - Ente Italiano di Normazione	Vice-president. UNI/CT 021/SC6 (U7306) Structural Engineering Committee/Subcommittee 6	Francesca da Porto
University of Padua	Vice-Rector for Sustainability; Rector's delegate for the New Padova Hospital	Francesca da Porto

Accademia Galileiana di Scienze Lettere ed Arti in Padova	Corresponding associate	Francesca da Porto
CEN - European Committee for Standardization	Italian Delegate - CEN/TC 250/SC 6 “Masonry Structures”	Francesca da Porto
CNR - ITC - Institute for Construction Technologies (Padova)	Associate	Francesca da Porto
Institute of Atmospheric Sciences and Climate (CNR)	Associate	Francesco Marra
Rutherford Appleton Laboratory, UK	Chair of the Panel for Cultural Heritage	Gilberto Artioli
IUCr International Union of Crystallography	Chair of the Commission on Crystallography in Art and Cultural Heritage	Gilberto Artioli
European Research Council	Member of the European Research Council Starting Grant Peer Review Panel PE10 (Physical Sciences and Engineering, Earth System Sciences).	Giulio Di Toro
Istituto Nazionale di Geofisica e Vulcanologia	Member of the Scientific Council of the Istituto Nazionale di Geofisica e Vulcanologia	Giulio Di Toro
Accademia Nazionale dei Lincei (Italy)	Member of the Commission Environment and Natural Hazards & Risks of the National Academy of Lincei	Giulio Di Toro
University of Padova	Supporto della Commissione di Valutazione UniPD per i PI vincitori di Starting Grant ERC candidati	Giulio Di Toro
University of Padova	Commissione Paritetica Scuola AMV	Jacopo Boaga
AIAR: Associazione Italiana di Archeometria	Member of the Organizing Committee of the AIAr Thematic Conference: La Sostenibilità nei Beni Culturali (“Sustainability in Cultural Heritage”) (Padova 29 June - 1July 2022)	Lara Maritan
AISA Associazione Italiana per lo Studio delle Argille	Member of the directive commission of the national group AISA (Italian Association for the study of Clays)	Lara Maritan
INGV	evaluator of projects presented to the INGV on cultural heritage	Lara Maritan
Italian Commission on Stratigraphy (CIS)	Member	Luca Capraro
Italian Commission on Stratigraphy (CIS)	Member	Luca Giusberti
Working group on the regional catalogue of Geosites of Veneto region	Member	Luca Giusberti

The Malta Council for Science and Technology	Member of the Proposals Evaluation Board	Luca Valentini
UNIPD	delegate of the rector for the signature of internships	Mario Floris
UNIPD	Vice Rector for Postgraduate and Doctorate Programmes	Massimiliano Zattin
National Science Center Poland	Expert	Massimiliano Zattin
European Space Agency	Member of the Solar System Exploration Working Group	Matteo Massironi
Società Italiana di Scienze Planetarie	socio Fondatore e membro del Consiglio Direttivo	Matteo Massironi
Società Geologica Italiana	Membro del direttivo della Sezione di Geologia Planetaria	Matteo Massironi
MUR	Member of the ASN Committee	Nicola Surian
Associazione Italiana di Geografia Fisica e Geomorfologia	Member of the Executive Committee	Nicola Surian
Associazione Italiana di Geologia Applicata ed Ambeintale (AIGAA)	Comitato direttivo	Paolo Fabbri
International Association of Hydrogeologists (IAH) - Commission on Mineral and Thermal Waters	Member	Paolo Fabbri
Commissione nazionale "Università, Istruzione e Ricerca" del Consiglio Nazionale dei Geologi (C.N.G.)	Member	Paolo Fabbri
UNIPD	(2017-present) Member of the “Commission for the University support of teacher’s education” (Commissione per il Supporto di Ateneo per la Formazione degli Insegnanti - SAFI.	Raffaele Sassi
UNIPD	(2020-present) Executive Board Interdepartmental Center for Research in History and Philosophy of Science, University of Padova (Consiglio Direttivo Centro Interdipartimentale di Ricerca in Storia e Filosofia della Scienza, CISFIS)	Raffaele Sassi
UNIPD	Member of the Board of Directors of the Ing. Aldo Gini Foundation	Raffaele Sassi
CIVIL, ENVIRONMENTAL AND ARCHITECTURAL ENGINEERING Department (UNIPD)	(2022-present) member of the “Teaching Committee” of the Department ICEA (UNIPD)	Raffaele Sassi
Master degree in Water and Geological Risk Engineering	Vice- President	Simone Bizzi

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MEENA	Geosciences
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SILVESTRI	Journal Of Cultural Heritage
SILVESTRI	Journal Of Cultural Heritage
RIGO	Journal Of Earth Science
MARRA	Journal of Hydrology
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CESARE	Journal Of Metamorphic Geology
CESARE	Journal Of Petrology
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CATANI	Natural Hazards And Earth System Sciences
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AGNINI	Stratigraphy
PICCININI	Sustainability
DI SIPIO	Sustainability

Projects and funding

PROJECTS AND FUNDING *by M. Ghinassi*

Research activities at the Department of Geosciences are supported by a wide range of funding sources, including competitive calls and agreements with companies, foundations, and local institutions. During 2023, these activities were largely complemented by two main projects that involved the majority of the department's researchers: "Geosciences for Sustainable Development" and "SYCURI". These two projects were sponsored by the Italian Ministry of University and Research (MUR), and from the University of Padova, respectively. Resources from these two projects allowed for remarkable progresses in research activities carried out at the Department. During 2023, 79 projects are underway under the guidance of Department's researchers, who acted both as principal investigators and partners. These projects encompass broad spectrum of topics ranging from fundamental research, which continuously explores new branches, to applied science, which is engaging an increasing number of researchers.

Forty competitive projects are underway at the Department, including two European Research Council (ERC) projects (one Consolidator Grant and one Starting Grant) and three Marie Skłodowska-Curie Individual Fellowships. In 2023 the Departments succeeded the competitive PRIN2022 and PRIN2022PNRR calls receiving fundings for twenty projects, which involves researchers of the Departments either as principal investigators or partners. Researchers of the Department are deeply involved in different activities and projects related with the National Recovery and Resilience Plan (Next Generation EU). During 2023, research projects with budget from the "Geosciences for Sustainable Development" Excellence Project. Support from University of Padova, allowed the Department to economically support 19 projects, which were assigned after internal calls. Fifteen projects are supported and carried out in collaboration with public institutions, such as the National Civil Protection and the Veneto Region.

These funding schemes show that the Department skillfully secures research funding from diverse sources and channels, allowing it to pursue a broad spectrum of research interests. They also highlight that the Department is flexible in adapting its research agenda to address contemporary themes and emerging areas of inquiry. This agile approach ensures that the Department remains at the forefront of research innovation and contributes effectively to addressing pressing societal challenges. During 2023, the Department was designated as the host institution by twenty-one researchers through both national and international competitive calls, demonstrating that it is highly regarded by researchers as an extremely efficient venue for conducting research activities. These research project focus on specific sites or areas that span a significant range, from regional locations such as the Dolomites, Venetian and Friulian Plain, and the Venice Lagoon, to areas of international interest including Africa, Asia, North and South America, Australia, and Antarctica. Additionally, some projects extend their scope to include other planets, such as Mars and Mercury.

GEOSCIENCE FOR SUSTAINABLE DEVELOPMENT 2023-2027 EXCELLENCE PROJECT OF ITALIAN MINISTRY OF UNIVERSITY AND RESEARCH *by M. Ghinassi*

Succeeding the Excellence Projects 2023-2027 competitive call of Italian Ministry of University and Research (MUR) certainly represented one of the most relevant events of 2023. The MUR Excellence Projects are accessible only to highly-qualified Italian departments, and the Geoscience Department succeeded with a project titled "Geosciences for Sustainable Development". This project aligns with the United Nations' Agenda 2030 Sustainable Development Goals (SDG), and focuses on 3 research areas: (i) climate change and risk mitigation, (ii) georesources for energy transition, and (iii) water resource and soil protection and management. The project budget includes recruitment, development and improvement of research infrastructures, economical support for research studies and updating the content of high-quality education.

Recruitment activities encompassed the hiring of three lecturers, one associate professor, and one technician. In December 2023, Dr. A. Finotello was appointed as a lecturer, focusing his research on the morphodynamic evolution of coastal systems under the influence of natural and anthropogenic forcings.

The specific objectives of the project in terms of infrastructure focus on the acquisition of computing and field equipment, as well as the establishment of a new laboratory. The three infrastructures intended to be developed in the project are: 1) Supercomputing and big-data analytics infrastructure with AI capabilities; 2) Field infrastructure for Earth Critical Zone monitoring; 3) Geochimical laboratory supporting the environmental geochemistry research line. Most of the infrastructures and equipment were acquired by the end of 2023, and it were confirmed to be operational by 2024 after undergoing testing. In June 2023, the Departmental Council approved a call for three research projects related to the main scientific objectives of the main project. In December 2023, the Committee's evaluation led to the funding of the following projects: i) Emissions and sources of gases with environmental impact (STEAM) - Prof. Bernardo Cesare; ii) Exploring Carbonate Rock Recession through Data Fusion of Extensive Experimental Data via Machine Learning (ERODEM) - Prof. Claudio Mazzoli; iii) Distribution and beneficiation of Critical Raw Materials in the LREE-fluor ore belt of the Roman Region (Italy) - Prof. Paolo Nimis.

Updating the content of high-quality education is scheduled in the project through: i) opening of six PhD scholarships linked to the themes of the excellence project; ii) Organizing summer schools focused on the project's research lines; iii) Establishing a course for doctoral students on the use of big data in the field of geosciences; iv) Creating a digital classroom dedicated to microscopy; v) Expanding the classroom dedicated to the use of virtual reality for geological mapping; vi) Activating new Erasmus fluxes, and vii) Providing scholarships for master's students from developing countries.

During 2023, three PhD students started their activity in the frame of the project, with the following projects :i) Advanced numerical modeling and remote sensing techniques for the characterization and assessment of georisks (Ph.D. candidate Junaid Khan; Supervisor Prof. Mario Floris); ii) Implications of carbonate mineralization in the mining sector (Ph.D. candidate Abdullah Abdulghany, supervisor Dr. Valentina Prigiobbe) and iii) Characterization of the soil-plant-atmosphere continuum (SPAC) and monitoring of mass and energy states and flows (Ph.D. candidate Matteo Censini; Supervisor Prof. Giorgio Cassiani).

Progress and project development can be tracked on the website: https://www.geoscienze.unipd.it/en/geosciences-sustainable-development-2023-2027-excellence-project

PROJECT NAME	HANDLER	FUNDING BODY
Supporto Scientifico Per L'implementazione E La Calibrazione Del Modello "Cascade"	Bizzi Simone	Libera Universita' Di Bolzano (UniBZ)
Paracelso – Predictive Analysis, Monitoring And Management Of Climate Change Effects Leveraging Satellite Observations	Bizzi Simone	Agenzia Spaziale Italiana
Support To The Development And Implementation Of The Iride Service Segment	Bizzi Simone	Planetek Italia Srl
Servizi Di Validazione Delle Rete Di Monitoraggio Microsismico Afferenti La Validazione Della Strumentazione E Del Dato Ottenuto Dalle Reti Di Monitoraggio	Boaga Jacopo	Stogit S.P.A.
Seasounds" 101119769 - Horizon Msca	Boschi Lapo	European Research Executive Agency (Rea)
Contr. Ric. Comm. Con A4 "Verifica E Valutazione Docum. Prodotta Dai Prestatori Di Servizio, Verifica Modelli Numerici, Modelli Bim..."	Da Porto Francesca	Autostrada Brescia Verona Vicenza Padova Spa
Nuova Appendice 1 Per L'espletamento Di Attività Di Studio E Ricerca Finalizzate Al Monitoraggio, All'analisi Del Campo Statistico Comune Di Verona,	Da Porto Francesca	Comune Di Verona
Conv. Sabap -Chiesa San Siro E Libera Per Attività Di Ricerca Al Supporto Scientific Attività Di Ricerca Relativa Al Supporto Scientifico Per Le Fasi Di Progettazione Ed Esecuzione Degli Interventi Di Prevenzione Del Rischio Sismico	Da Porto Francesca	Soprintendenza Archeologia Belle Arti E Paesaggio Per Le Province Di Verona, Rovigo E Vicenza
Strategie Di Risk Management Per La Resilienza Del Sistema Casa	Da Porto Francesca	Regione Veneto
Valutazione Dell'evoluzione Recente Del Pendio Localizzato In Sponda Sinistra Del Torrente Boite Attraverso Tecniche Di Telerilevamento	Floris Mario	O2H Engineering Srls
Realizzazione E Informatizzazione Dei Dati Relativi Ai Depositi Quaternari Ricadenti All'interno Dei Fogli Geologici Alla Scala 1:50.000 N. 088 "Gorizia", 110 "Trieste" E 131 "Caresana»	Fontana Alessandro	University Of Trieste
Consulenza Scientifica Sorgente Valcimoliana Srl Per La Realizzazione Di Un Sistema Geotermico Dedicato Alla Climatizzazione Della Sede Produttiva Sita In Cimolais (PN)	Galgaro Antonio	Sorgente Valcimoliana S.R.L.
Comune Di Montalcino (Si): Accordo Di Collaborazione Scientifica Per La "Condivisione Di Conoscenze Tecnico-scientifiche Per Lo Svolgimento Di Una Misura Sperimentale Di Caratterizzazione Termofisica Del Sottosuolo	Galgaro Antonio	Finanziatore Fittizio N.A.C.
Joint Study Of A Sediment Core From The "Riu Mare Foghe" (Oristano, Sardinia) To Reconstruct The Evolution Of The Environment, The Role Of Human Impact, And The Settlement	Nicosia Cristiano	Brown University - Joukowsky Institute For Archaeology And The Ancient World
Collaborazione Scientifica Sullo Studio Paleoambientale Della Torbiera Del Monte Rove (Recoaro, Vi)	Nicosia Cristiano	Dipartimento Di Culture E Civiltà - Università Degli Studi Di Verona
Interreg VI-A Italia-Slovenia 2021-2027 -"Kras-carso II"	Preto Nereo	Regione Autonoma Friuli Venezia Giulia
Closing The Loop: Building Circular Skills On The Entire Value Chain- Clocks	Salviulo Gabriella /Nestola Fabrizio	Eit Raw Materials
Carta Geologica Ufficiale D'Italia Foglio N. 084 Vittorio Veneto .	Stefani Cristina	Ispra - Istituto Superiore Per La Protezione E La Ricerca Ambientale
CARG - Carta Geologica ufficiale d'Italia alla scala 1:50.000, Foglio 087 "Palmanova".	Fontana Alessandro	ISPRA - Istituto Superiore Per la Protezione e la Ricerca Ambientale

PROJECT NAME	HANDLER	FUNDING BODY
CARG - Carta Geologica ufficiale d'Italia alla scala 1:50.000, Foglio 127 "Mestre".	Paolo Mozzi	ISPRA - Istituto Superiore Per la Protezione e la Ricerca Ambientale
CARG - Carta Geologica ufficiale d'Italia alla scala 1:50.000, Foglio 061 "Borgo Valsugana".	Silvana Martin	Provincia Autonoma di Trento
AT Unimpresa "Piattaforma Per La Valutazione Del Rischio: Innovazione Insurtech Per La Stima Di Perdite Economiche (Platform For The Evaluation Of Risk: Insurtech Innovation For Loss Estimation) Peril"	Da Porto Francesca	Unipd And Riskapp S.R.L.
Tread - Data And Processes In Seismic Hazard	Di Toro Giulio	Horizon - Msca Doctoral Networks 2021
Deep U-tube Heat Exchanger Breakthrough: Combining Laser And Cryogenic Gas For Geothermal Energy Exploitation	Galgaro Antonio	European Innovation Council And Smes Executive Agency (Eismea)
EPN-2024-ri - Europlanet 2024 Research Infrastructure (RI)	Massironi Matteo	European Commission
HYPERION - Development of a decision support system for improved resilience & sustainable reconstruction of historic areas to cope with climate change & extreme events based on novel sensors and modelling tools.	Mazzoli Claudio	European Commission - H2020
THETIDA - Technologies and methods for improved resilience and sustainable preservation of underwater and coastal cultural heritage	Mazzoli Claudio	European Commission - H2020
Uses Of Ultrasonic And Seismic Embedded Sensors	Nesterova Olga	Horizon - Msca Doctoral Networks 2021
GEOarchaeology Of DAily Practices: Extracting Bronze Age Lifeways From The Domestic Stratigraphic Record - GEODAP	Nicosia Cristiano	European Research Executive Agency
Diamonds As The Key To Unravel The Origin Of Earth's Water - INHERIT	Pamato Martha Giovanna	European Research Executive Agency
Monifaults - Monitoring Real Faults Towards Their Critical State	Poli Piero	European Research Executive Agency
Reviewing And Integrating Methods For The Conservation Of European Architectural Finishes In Urban Heritage Townscapes - Clea	Artioli Gilberto	European Research Executive Agency
Tackling Seismicity At Etna Using Repeating Sources, Relocations And Ambient Noise Monitoring	Eyles Jade Hannah	European Research Executive Agency
Climate Change Risk To Underwater Cultural Heritage In Stone - Wateriskult	Mazzoli Claudio	European Research Executive Agency
Carbon Release In A Warming Climate: A Proxy Data Model Comparison For The Analysis Of Past Episodes And Future Scenarios (CRAWL)	Agnini Claudia	Italian Ministry Of University And Research
Green Rivers	Bizzi Simone	Italian Ministry Of University And Research
River-watching: Dynamic Morphological Indices To Understand River Functioning	Bizzi Simone	Italian Ministry Of University And Research
Swim: Assessing The Impact Of Offshore Wind Turbines On Marine Mammals In The Adriatic Sea	Boschi Lapo	Italian Ministry Of University And Research
TErrestrial And Marginal System In A Hot World (Teams). The Continental And Marginal-marine Cenomanian Environments Of The Southern Morocco Between Climate Extreme	Breda Anna	Italian Ministry Of University And Research

PROJECT NAME	HANDLER	FUNDING BODY
Timing, mode And Tempo Of The Major Climatic Transitions Of The Early Pleistocene: A Central Mediterranean Perspective (TIMOTEO)	Capraro Luca	Italian Ministry Of University And Research
Predictive Dynamics Of Microbiological Contamination Of Groundwater In The Earth Critical Zone And Impact On Human Health River-watching: Dynamic Morphological Indices To Understand River Functioning	Cassiani Giorgio	Italian Ministry Of University And Research
Nano-focus On Metamorphic Garnet (Nanomega)	Cesare Bernardo	Italian Ministry Of University And Research
New Integrated Approach For Seismic Protection And Valorisation Of Heritage Buildings On Historical Soil Deposits (New Age)	Da Porto Francesca	Italian Ministry Of University And Research
Eco-geomorphic Carbon Pumping From Rivers To Blue Carbon Ecosystems	D'alpaos Andrea	Italian Ministry Of University And Research
The Seismic Cycle Under Hydrothermal Conditions: Experimental, Analytical And Modeling Studies	Di Toro Giulio	Italian Ministry Of University And Research
Volando - Volcanic Plume Characterization Using Sounnding Balloons	Faccenda Manuele	Italian Ministry Of University And Research
Ensuring Resilience Of The Po River Delta To Rising Relative Sea Levels Using Naturebased Solutions For Building Land And Mitigating Subsidence	Finotello Alvise	Italian Ministry Of University And Research
Climatic Impact On Terrestrial And Marine Realms Of The Eastern Mediterranean At The Plio-Pleistocene Transition	Ghinassi Massimiliano	Italian Ministry Of University And Research
The Lagoon Of Venice In Antiquity Settlement Dynamics, Adaptive Behaviours, Paleoenvironmental Reconstructions	Mozzi Paolo	Italian Ministry Of University And Research
Lord Of The Rings: Dendro-isotopic Curves From Archaeological Wood To Reconstruct Mid-holocene Climate Evolution And Human Impact	Nicosia Cristiano	Italian Ministry Of University And Research
Dirt And Excrements: Integrating High-resolution Sediment Analysis And Advanced Biomolecular Archaeology (Terra Ed Escrementi: Analisi Ad Alta Risoluzione Dei Sedimenti Integrata Con Metodi Avanzati Di Archeologia Biomolecolare) - DIANE	Nicosia Cristiano	Italian Ministry Of University And Research
High-stress Earthquakes By Faulting In Deep Dry Rocks (THALES)	Pennacchioni Giorgio	Italian Ministry Of University And Research
Cpe Drilling Project: Digging Into Triassic Extreme Climate Change (CDP)	Preto Nereo	Italian Ministry Of University And Research
Oceans – Impacts Of Acidification On Past Biodiversity: Insights From Marine Vertebrates	Rigo Manuel	Italian Ministry Of University And Research
Recent Environmental Changes In The North Atlantic Revealed By Cold-water Coral Geochemistry And Implications For The Arctic Warming (Ice-corals)	Rigo Manuel	Italian Ministry Of University And Research
Prediction Of Rainfall-induced Landslides - Improving Multi-scale Territorial Early Warning Through Artificial Intelligence	Rosi Ascanio	Italian Ministry Of University And Research
Fastheal: Fault Strength Recovery At Hydrothermal Conditions, An Experimental And Field Insight	Tesei Telemaco	Italian Ministry Of University And Research

PROJECT NAME	HANDLER	FUNDING BODY
Berg - Bed Load Of Mountain Rivers Grabbed By Low-cost Acoustic Sensors	Boaga Jacopo	University Of Padova
Stars Grants "Slow To Instantaneous Fracture Sealing By Chemically-active Fluids: The Damage-recovery Cycle In Fault Zones - Stiff"	Fondriest Michele	University Of Padova
Assegno Sid - Caratterizzazione Morfometrica E Sedimentologica Dei Sistemi Fluviali Tardo Olocenici Della Pianura Veneta	Ghinassi Massimiliano	University Of Padova
Carbon Cycling In The Deep Crust	Krona Mikaela Emma	University Of Padova
Progetto Sid - Clisopp – Influenze Of Clay Processing On Bulk Chemistry And Isotope Signature In Ancient Pottery Productions	Maritan Lara	University Of Padova
Temperature-dependent Non-asymptotic Model For Extreme Precipitation (Tenax)	Marra Francesco	University Of Padova
Combining Web Data Mining And Landslide Detection Tools To Improve Landslide Hazard Forecasting	Rosi Ascanio	University Of Padova
A Comprehensive Approach To Understand The Complex Link Between The Geogenic Radon And Human Health	Sassi Raffaele	University Of Padova
Progetto Sid - Critical, Precious And Base Metals On Mid-ocean Ridges And In Ophiolites: Where And How?	Nimis Paolo	University Of Padova
Resolving Fault Related Deformation In The Upper Crust Using Passive Seismic Imaging (Central Apennines, Italy)	Poli Piero	University Of Padova
Assegno Sid - Resolving Fault Related Deformation In The Upper Crust Using Passive Seismic Imaging (Central Apennines, Italy)	Poli Piero	University Of Padova
Progetto Sid - Combining Web Data Mining And Landslide Detection Tools To Imp Rove La Ndslide Hazard Forecasting	Rosi Ascanio	University Of Padova
Assegno Sid - Sintesi E Caratterizzazione Di Nanocompositi Colloidali Avanzati TiO2/γ-Fe2O3 Per Un Risanamento Ambientale Sostenibile	Salviulo Gabriella	University Of Padova
Progetto Sid - Macro To Micro Scale Geological Constraints On Geogenic Radon Hazard Assessment (Hazrad)	Sassi Raffaele	University Of Padova
Assegno Sid - A Comprehensive Approach To Understand The Complex Link Between The Geogenic Radon And Human Health	Sassi Raffaele	University Of Padova
Emissions And Sources Of Gases With Environmental Impact (STEAM)	Cesare Bernardo	Excellence Project - Italian Ministry Of University And Research
Exploring Carbonate Rock Recession Through Data Fusion Of Extensive Experimental Data Via Machine Learning	Mazzoli Claudio	Excellence Project - Italian Ministry Of University And Research
Distribution And Beneficiation Of Critical Raw Materials In The LREE-fluor Ore Belt Of The Roman Region (Italy)	Nimis Paolo	Excellence Project - Italian Ministry Of University And Research

Laboratories

LABORATORY FACILITIES *by S. Monari*

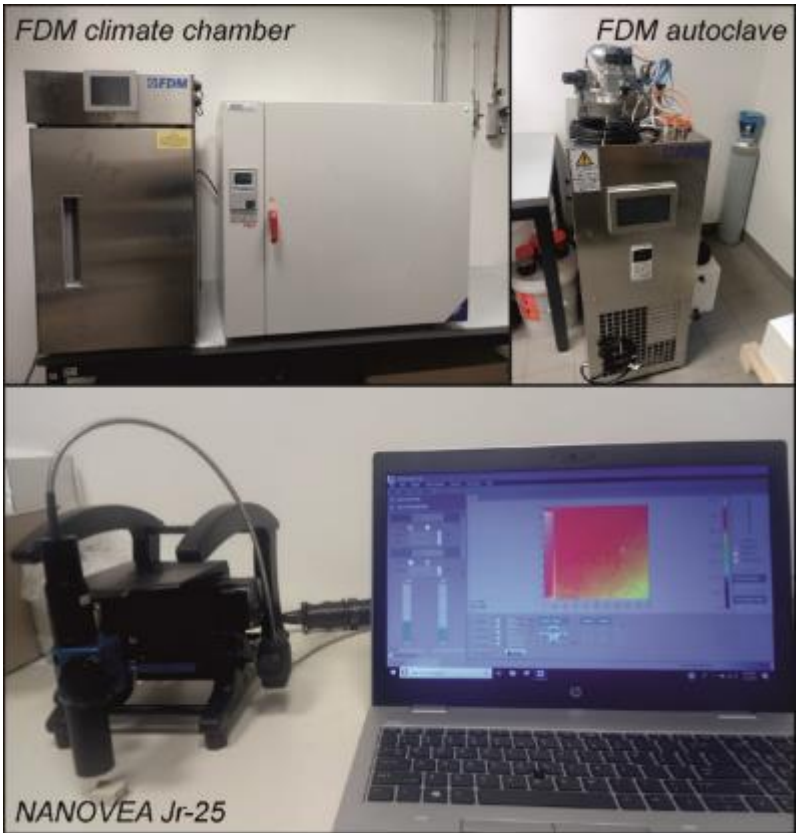
A relevant addition to the facilities of the Department is the Laboratory of Micromorphology for the production of soil and sediment thin sections. This laboratory will be fully operational in 2023 and has been realized with the funding provided by the ERC Consolidator project GEODAP (Geoarchaeology of Daily Practices) and by the FARE – Ricerca in Italia project DIANE (Dirt and Excrements). Thanks to the funding provided by the development plan of the Department, new equipment and instruments have been acquired to improve the efficiency of our laboratories. At the beginning of 2022, a new high-performance XRF spectrometer (sequential WDS Malvern Panalytical Zetium) was installed in the X-ray Fluorescence Spectroscopy Laboratory. The Laboratory of Applied Petrography has been equipped with the portable optical profilometer NANOVEA Jr-25, the ArgoLab TCF200 Plus oven, an FDM climate chamber and a new 20 L autoclave customized by FDM. Since 2021, the ROtary Shear Apparatus (ROSA) of the Rock Mechanics Laboratory has been equipped with the hydrothermal vessel HYDROS. The laboratory also hosts an electromechanical universal tester, installed in 2022. Moreover, a laser diffraction particle size analyser Malvern Panalytical Mastersizer 3000 has been installed in the Geological Sample Preparation Laboratory. By the end of 2022, the technical staff of Geosciences Department was composed of 11 technicians operating in 25 laboratories. Operational activities in other ten laboratories were supported by researchers and temporary staff.

MICROMORPHOLOGY LABORATORY

This laboratory is particularly intended for archaeological studies. It produces 60x90 mm thin sections, significantly larger than standard petrographic slides. Another difference with petrography is that, unlike rocks, archaeological sediments, soils, and other unconsolidated earth materials are very loose and friable. As such, they require consolidation before they can be transformed in 30 µm-thick thin sections. Given that in this lab health and safety are priorities, consolidation is done with VOC- and diluent-free epoxy resins instead of hazardous polyester resins that are normally diluted with acetone or styrene. The choice of epoxy resin has been done after testing several products and trying different recipes. Total fume evacuation and dust trapping are assured throughout all the steps of the thin section production process. The laboratory relies on a large Memmert lab oven for preliminary sample drying. Consolidation with epoxy is done in a vacuum oven positioned within a fume cupboard, vacuum being necessary for resin to deep into the sample. With the proper combination of epoxy and vacuum the laboratory is capable of consolidating samples containing clay, peat, organic matter, "spongy" charcoal fragments, or heterogeneous archaeological materials like bone, metals or ceramic. Once the blocks are cured they are first cut with a Remet RT100 L diamond blade saw and trimmed down with a Logitech GTS-1 saw. This machine is also used to cut off the excess sample after the chips are glued to the glass. Lapping can be done with loose abrasives using a Logitech LP70 lapping machine or with a diamond grinding wheel on a BROT multiplate grinder. The laboratory is run by a dedicated laboratory technician, and as such is fully equipped to deliver, in a few weeks time, high-quality thin sections of archaeological soils and sediments for the GEODAP and DIANE projects.

LABORATORY OF APPLIED PETROGRAPHY

A series of new facilities have been acquired and installed in the Laboratory of Applied Petrography The first one is a NANOVEA Jr-25 portable optical profilometer. Based on chromatic confocal optical technology (axial chromatism), with the specific optical pen that we acquired, this equipment allows mapping surface topography over areas up to 25 x 25 mm, with vertical measuring range up to 1.1 mm and vertical resolution of 4 nm, providing the following standard surface measurement parameters: 3D and 2D mean roughness (Ra, Sa), root mean square roughness (Rq, Sq), maximum height (Rz, Sz), maximum pit height (Rv, Sv), skewness (Rsk, Ssk), kurtosis (Rku, Sku), and many more. This instrument is used to measure the surface topography of many different geological materials, e.g. to determine the recession of carbonate stones used in the cultural heritage. In the same Laboratory, an ArgoLab TCF200 Plus oven and an FDM climate chamber has been installed. The latter equipment allows controlling and programming relative humidity in the range 20-98% and temperature between -20°C and +70°C, with a net internal volume of 130 L, and is used to conduct accelerating aging tests on stones and other materials. Furthermore, a new 20 L autoclave has been installed in the same laboratory, customized by FDM in order to provide possible temperatures in the range 0-100°C and pressure up to 10 bars. By controlling the flux of CO_2 and monitoring pH of water inside the chamber, it is possible to simulate the environmental conditions of underwater cultural heritage according to different ICPP scenarios, and evaluate their deterioration rate.

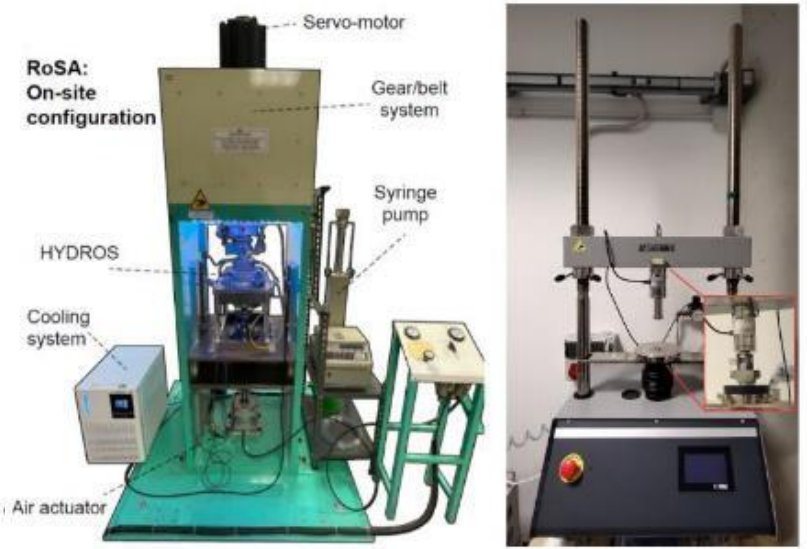


XRF SPECTROMETRY LABORATORY

The new X-ray fluorescence spectrometer installed in this laboratory is a sequential WDS Malvern Panalytical Zetium operating in vacuum conditions. The instrument is equipped with a 2.4 kW Rh X-ray tube, 5 analyzer crystals (LiF220, LiF200, Ge, PE, PX1), 3 detectors (gas flow proportional counter, scintillator and sealed Xe), 2 collimators (150 µm and 550 µm), 4 filters (Al 200 µm, Al 750 µm, Brass 100 µm and Brass 400 µm) and a sample changer for 16 sample holders. For calibration, geological international standards were used (Geostandards Newsletter, Vol. XVIII, Special Issue, July 1994, K. Govindaraju, ed.) to measure the following major, minor and trace element: Si, Ti, Al, Fe, Mn, Mg, Ca, Na, K e P (expressed in oxide %), and Sc, V, Cr, Co, Ni, Cu, Zn, Ga, Rb, Sr, Y, Zr, Nb, Ba, La, Ce, Nd, Pb, Th e U (expressed in part per million ppm). Measurements are normally performed on beads, prepared using the sample calcined powder diluted with di-lithium tetraborate flux (Li2B4O7) with a ratio of 1:10, using a Claisse Eagon 2 fusion instrument (running at a maximum temperature of 1150°C). Analysis can be also performed on pressed powder pellets when beads cannot be prepared from the original sample. During the first months of work of the laboratory, various materials have been analyzed, such as rocks, clays, ceramics.

ROCK MECHANICS LABORATORY

In this laboratory is installed a ROtary Shear Apparatus (ROSA) equipped with an hydrothermal vessel (HYDROS) designed to study the seismic cycle in experimental faults in the presence of hot and pressurized fluids (H2O in vapor, liquid and supercritical conditions). These experiments are of interest for the safe exploitation of medium- and high-enthalpy (100-450°C) geothermal fields, for subsurface fluid storage, but also for understanding seismic sequences in volcanic environments (Campi Flegrei, etc.) and their relationships with eruptive activity. ROSA & HYDROS will be also dedicated to the study of the seismic cycle at deeper crustal levels (e.g., mechanics of slow slip events, seismicity in fluid-rich environments). The laboratory hosts an uniaxial press (Controls Uniframe series) hosted in equipped with 100 kN and 25 kN load cells used to perform uniaxial compression, bending and brazilian disk tests on cement, mortar and rock samples. Thanks to a specifically designed apparatus (by E. Garbin) specimens with dimension of 1,5 x 1,5 x 6 cm3 can be tested complying to requirements of standard EN 196:1 (2005). The laboratory also hosts two large 2000 kN hydraulic presses equipped with Hoek cells (P up to 60 MPa), recently refurbished in 2023. These machines are suitable for fracture tests on large rock and concrete specimens or for doom-dry triaxial tests at upper crustal pressure conditions.



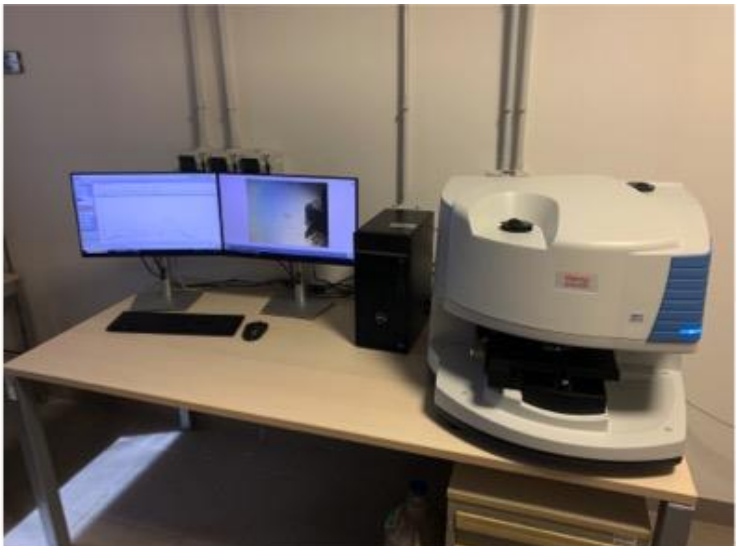
GRAPHIC AND PHOTOGRAPHY LABORATORY

By the beginning of 2021, the new drone DJI Phantom 4 rtk has reached full operational activity. The drone is a complete aerial imaging solution mainly used for photogrammetric monitoring and geomorphological mapping. It is integrated with a Gps RTK system offering centimeter-level accurate location coordinates. It has been extensively used in tracking riverbed morphology, in collecting data for mapping rock walls in quarries. The obtained aerial images are elaborated into 3D digital data by using photogrammetric softwares as Metashape and 3DFZephyr.

NEW INHERIT FACILITIES

The ERC funded INHERIT (ERC-2021-STG Grant Agreement ID: 101041620) project aims to investigate the origin of Earth's water, a fundamental question in geology, planetary science, and astrobiology. While there are several hypotheses regarding the source of water on Earth, the exact mechanisms and timing of its origin on our planet remains unknown. The INHERIT team is addressing this conundrum analyzing the geochemical and isotopic composition of diamonds, and the mineral and fluid inclusions they contain. Diamonds are "time capsules" coming from the depth of the mantle that may preserve direct information on the ancient sources of water in the Earth's early history. In the framework of the "INHERIT' several new facilities have been acquired. Those facilities include a new Fourier-Transform InfraRed spectrometer (ThermoFischer Nicolet Ni10) dedicated to the analysis of defects (e.g. related to the presence of N, B and H) and inclusions in diamonds, and a new, custom-made diamond polishing bench (both installed at the Single-Crystal XRD Lab).

A new Elemental Analyzer - Isotope Ratio Mass Spectrometer (Thermo Scientific EA Isolink Delta Q Isotope Ratio Mass Spectrometer EA-IRMS), installed in the Mass Spectrometry IRMS Lab, will allow precise elemental and isotopic measurements of highly refractory minerals, such as diamond.



LIST OF LABORATORIES AT THE DEPARTMENT OF GEOSCIENCES, YEAR 2023

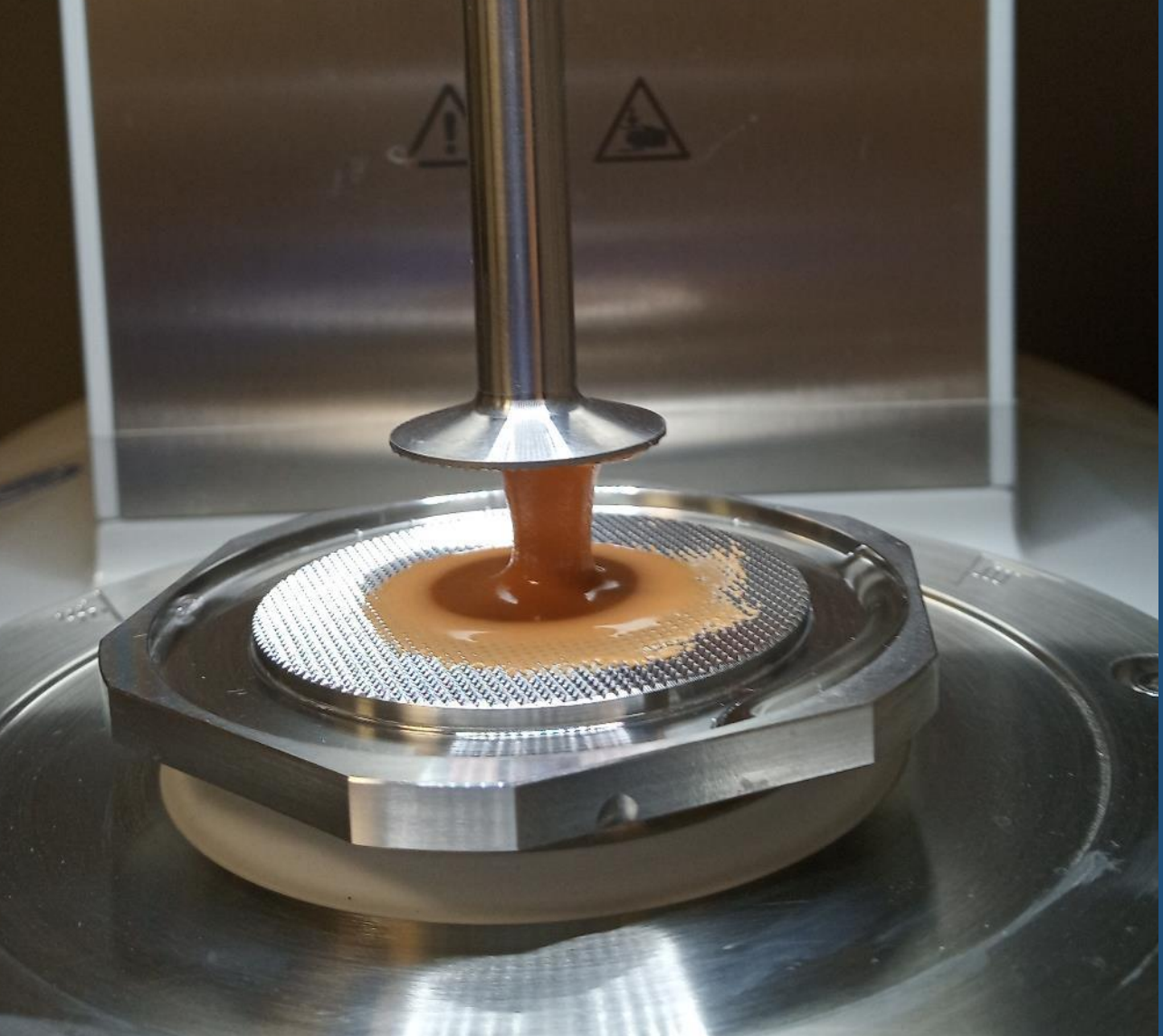
1	Applied Mineralogy	18	Micromorphology
2	Applied Petrography	19	Micropaleontology
3	Catodoluminescence and fluid inclusions	20	Micro-Raman Spectroscopy
4	Cleanroom- sample preparation for isotopic analyses	21	Micro-Tomography
5	Confocal Optical Microscope	22	Mineral Resources
6	Dual beam FIB-FE-SEM	23	Mineral separation
7	Exeperimental Petrology and Geochemistry	24	Palynology
8	Fitoplancton	25	Rock mechanics
9	Geochemical Preparation laboratory	26	Scanning Electron Microscopy
10	Geological sample preparations	27	Sedimentology
11	Geophysics	28	Rock Crushing
12	Graphic and photography	29	Thermal lab
13	Hydrogeology	30	Thermocronology
14	Hyperspectral analysis	31	Thin section preparation
15	Fluid and melt Inclusions	32	X-ray Fluorescence Spectroscopy (maintenance in 2021)
16	Macropaleontology	33	X-Ray Powder Diffraction
17	Mass Spectrometry - IRMS	34	X-Ray Single Crystal Diffraction

Museums

MUSEUMS

by L. Giusberti

The Department of Geosciences owns extensive collections of Italian and foreign rocks, fossils and minerals housed at "Palazzo Cavalli" in the Museum of Geology and Paleontology, and in the Museum of Mineralogy. Such huge scientific and cultural heritage has its roots in the old collections of the Natural History Museum of the University of Padova, founded in 1733 thanks to the donation by Antonio Vallisneri Jr. Besides the scientific activities, carried out by Italian and foreign researchers from all over the world, the Museum's staff, coordinated by CAM (Centro Ateneo Musei), carried out in the last years an intense activity of public engagement with the fruitful support of the Department's researchers. After three years of very intense work, on 23rd June 2023 eventually opened at Palazzo Cavalli the new "Museum of Nature and Humankind" (MNU) that include the former Department's collections along with the University collections of Zoology and Anthropology. Nonetheless, the Department of Geosciences continues to maintain scientific oversight of its geopaleontological and mineralogical collections through two scientific officers serving on the MNU Scientific Committee. In just six months since its inauguration, the MNU has welcomed more than 50000 visitors. Along with MNU, the Botanical Garden and the Palazzo del Bo form a cohesive trio of cultural sites within the 'Padua City of Science' itinerary, operating in close synergy.



CIRCe

CIRCe – Centre for the Investigation of cement materials

by M.C. Dalconi and G. Artioli

CIRCe is an interdepartmental centre devoted to the promotion and development of scientific research activities on cement-based and alternative binders, aiming at integrate fundamental research, applied research and industrial research in the field of construction materials. The centre initially started as a collaboration between the Department of Geosciences and the Department of Civil, Construction and Environmental Engineering (ICEA) to answer the need expressed by several companies to coordinate research in the field of building materials. The centre subsequently welcomed the Department of Cultural Heritage (DBC) and the Department of Industrial Engineering (DII) who also joined the project. The Centre acts as research partner for a number of Institutions and private Companies, among them MAPEI S.r.l. and ENI S.p.a. covered an important role for financial support and research collaboration. CIRCe is a corporate member of RILEM (International Union of Laboratories and Experts in construction Materials, Systems and Structures).

2023 marked 13 years of cement and binder research here at CIRCe – Department of Geoscience. The core of CIRCe's activity continues to be the study of cement hydration under the influence of admixtures, although substantial efforts in recent years were devoted to the development of clinker-free binders and geopolymers, in order to improve the sustainability and the carbon footprint of construction materials, in the frame of a truly circular economy. Our industrial and applied research includes active collaborations between the CIRCe group at the Department of Geosciences and OPIGEO, a spin-off company of Unipd, providing support and research for the efficient use and recycling of industrial by-products in building industry. An important piece of research was also devoted to deep our knowledge on the mechanisms controlling retention of heavy metals (lead) in soils stabilized through solidification/stabilization process using different cementitious binders. The consultancy and research activities with private companies extended through agreements assisted by UNISMART and involving important industrial companies such as Piazzetta Group, Industrie Cotto Possagno S.p.a., Breton S.p.A., and others. As part of projects involving the investigation of the architectural heritage, the centre offers a number of services in the field of archaeometric investigations of ancient building materials, including characterization and radiocarbon dating of ancient lime binders, and support for restoration materials.

Circe group at Geosciences Department and collaborators. Back row, left to right: Michele (dBC), Luca, Maurizio (Opigeo), Gregorio (IGG-CNR), Alessandro, Filippo, Mauro, Gilberto, David (Louvre), Sebastien (Louvre), Benoit (Louvre), Valeria (dBC), Simone (dBC). Front row, left to right: Yikai, Riccardo, Chiara, Caterina, Chiara, Anna, Giulia.

DIPARTIMENTO DI GEOSCIENZE

dBC

CIRCe

Centre for the investigation of cement materials

ICEA

CARG

CARG

by C. Stefani, A. Fontana, P. Mozzi, N. Preto

The national Project CARG, which deals with the New Geological Map of Italy has re-started since 2020. Our Department is actively involved, with many researchers coordinating field surveys, interpreting data and improve cartographic representation. Currently, surveys are on-going on sheets Palmanova, Gorizia, Trieste, Mestre, Vittorio Veneto, Borgo Valsugana, and more will be activated in the next years.

The CARG Project is led by ISPRA – National Geological Survey in cooperation with the Italian regions and Universities. The geological maps are surveyed at scale 1:10,000, implemented in a geodatabase at scale 1:25,000 and published at 1:50,000. Besides the classical surface map, some sheets have also a subsoil map and a 3D model of the geology. The products represent important instruments of synthesis between basic and applied geological research, as well as an indispensable tool for the local administrations in territorial management and planning.

PhD programme

PhD PROGRAMME *by C. Agnini*

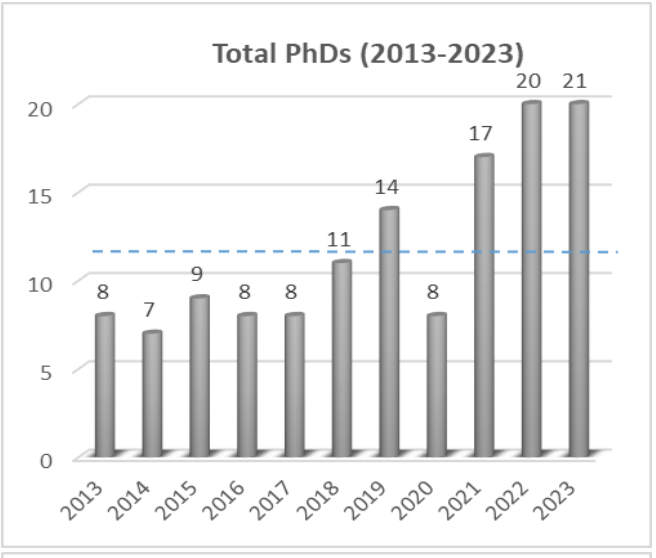
The governing body of the Doctoral course in Geosciences is the PhD Board, which includes a total 52 members: 38 faculty staff of the University of Padua, 13 high-reputation foreign researchers and one Italian external member (INGV – Rome). The representatives of doctoral students, whose number is equal to 15% of the total members of the board, are also part of the governing body (https://www.geoscienze.unipd.it/corsi/phd-course/phd-board). In 2023, the active series comprised XXXVI, XXVII, XXXVII, and XXXIX, with the XXXVI series formally concluding on September 30th and the XXXVII series commencing on October 1st. The total count of PhD candidates stood at 66 (Figure 1). The ongoing research projects cover a wide array of disciplines within the geosciences, encompassing both pure research aimed at deepening our comprehension of Earth's system and practical research endeavors. These practical projects are dedicated to examining natural phenomena and human-induced hazards, with the overarching goal of addressing the persistent geological, societal, economic challenges, and risks we face. In total, there are 21 scholarships for the XXXIX series in 2023, which sets a new record compared to the previous year. These scholarships are funded by various entities including the University of Padova, governmental bodies (e.g., Ministry of University and Education), private companies, and research projects provided to faculty staff:

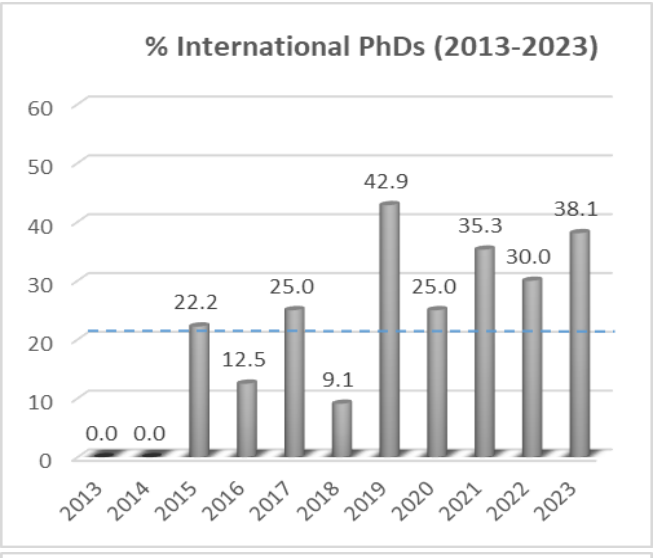
Funding body	Nr. of scholarships
University of Padova	6
Department of Excellence Project "Geosciences for Sustainable Development" (2023/2027)	3
European Research Projects (Diane, Tethida)	2
MSCA Doctoral Programmes (UNIPhD, USES2, and TREAD)	4
CARIPARO-UniSMART	1
PNRR National Recovery and Resilience Plan)- Part of the Next Generation EU (NGEU) programme to counter the COVID-19 pandemic (DM 117/23 and DM 118/23)	4
CSC - China Science Council	1
TOTAL	21

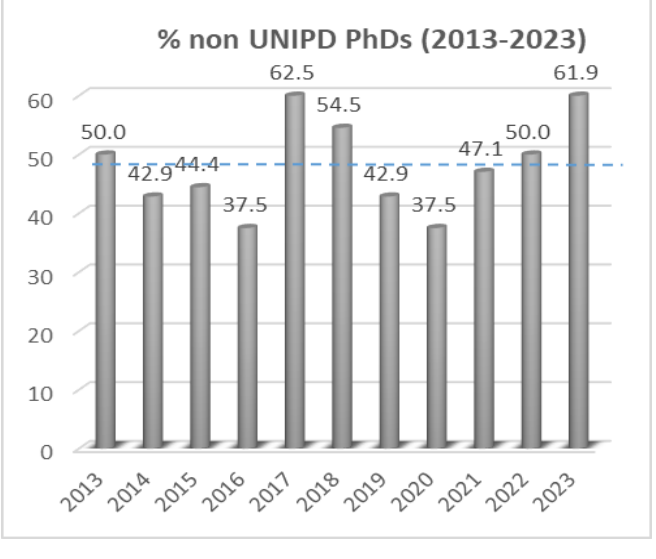
Over the past decade, we've welcomed a total of 131 PhD students into our program. The number of scholarships has been increasing, averaging around 16 per year over the last five years. Looking at the composition of our cohorts from 2013 to 2023, we've observed a significant rise in the percentage of international doctoral students since 2015, averaging at 34% over the last five years (Figure 2). Our active PhD candidates come from all five continents - Europe, Africa, America, Asia, and Australia - representing 18 different countries, including Brazil, Cameroon, China, Costa Rica, Colombia, Egypt, France, Germany, India, Iran, Kenya, Nepal, New Zealand, Pakistan, Russia, Sweden, Taiwan, and the USA. This diverse mix fosters an innovative environment where Italian and international students can engage positively, respecting each other's cultural backgrounds and identities. Interestingly, almost half (48%) of our PhD students over the last decade did not complete their master's degree at the University of Padua (Figure 3), demonstrating the appeal of our doctoral project outside our direct academic circle.

Geosciences fall within the broader STEM (science, technology, engineering, and mathematics) disciplines, which typically exhibit a gender disparity among master's degree students. This trend is reflected in the field of Geosciences, where approximately 65-70% of students are male and 30-35% are female. However, the proportion of female students increases to 50% at both the national and local (Padua) levels when it comes to doctoral studies. Over the past decade, our program has seen fluctuating gender ratios due to the relatively small number of available PhD positions, as depicted in the scissor graph (Figure 4). Nevertheless, when considering a ten-year timeframe (2013-2023), the average gender distribution is relatively balanced, with females comprising 48.1% and males 51.9%. Unfortunately, this equality often undergoes significant shifts in favor of males as individuals progress in their careers.

To all our current PhD students, we're rooting for you as you dive into your research projects. Hoping you are surrounded by inspiration and support, and may your hard work pay off just the way you want it to. For those who defended their theses in 2023 (XXXV series), here's to a bright future ahead. Best of luck with everything that comes your way!


Total PhDs (2013-2023)
20
15
10
5
0
8
7
9
8
8
11
14
8
17
20
21
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023


% International PhDs (2013-2023)
60
50
40
30
20
10
0
0.0
0.0
22.2
12.5
25.0
9.1
42.9
25.0
35.3
30.0
38.1
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023


% non UNIPD PhDs (2013-2023)
60
50
40
30
20
10
0
50.0
42.9
44.4
37.5
62.5
54.5
42.9
37.5
47.1
50.0
61.9
2013
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2017
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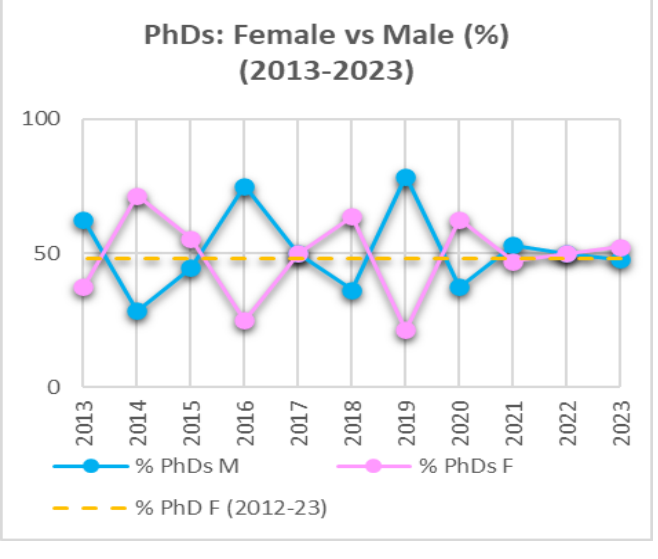
2020
2021
2022
2023


PhDs: Female vs Male (%)
(2013-2023)
100
50
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
% PhDs M
% PhDs F
% PhD F (2012-23)

Collaborations

COLLABORATIONS

by L. Valentini

The Department of Geosciences is dedicated to constantly growing its global network of partner institutions, enhancing its international standing, and becoming more appealing to foreign lecturers and students. International personnel at the Department of Geosciences currently includes 4 assistant professors, 15 post-doctoral researchers and 20 PhD students. Two Master's degree programmes and one new Bachelor's degree programme are fully delivered in English and are open to international students.

Other than providing courses taught in English, the Department of Geosciences offers numerous destinations for student and staff exchange programs. This includes 14 Erasmus+ agreements with EU universities, as well as an Erasmus+ KA171 agreement with a university in Kenya, and one agreement within the Swiss European Mobility Programme. New mobility programmes are currently being negotiated. During 2023, the Department of Geosciences also hosted XXX visiting professors and scientists, from all continents.

ITALY

University of Bari, Department of Earth and Geoenvironmental Sciences
University of Bologna, Department of Chemistry "Giacomo Ciamician"
University of Bologna, Department of Cultural Heritage
University of Bologna, Department of Industrial Engineering, Laboratory of radioprotection
University of Bozen
University of Catania
University of Chieti-Pescara “D’Annunzio”
University of Ferrara
University of Modena and Reggio Emilia
University of Naples “Federico II”, Department of Civil and Environmental Engineering
University of Pavia
University of Rome “La Sapienza”
University of Salento, Department of Antiquity Sciences
University of Siena
University of Turin, Department of Earth Sciences
University of Tuscia, Department of Ecological and Biological Sciences
University of Venice “Cà Foscari”, Department of Environmental Sciences, Informatics and Statistics
University of Venice “Cà Foscari”, Department of Human Studies
University of Venice IUAV
University of Campania "L. Vanvitelli", Department of Environmental, Biological and Pharmaceutical Sciences and Technologies
Polytechnic of Milan
CNR-IGAG, Institute of Environmental Geology and Geo-Engineering, Milan
CNR-IGAG, Institute of Environmental Geology and Geo-Engineering, Rome
CNR-IGG, Institute of Geosciences and Georesources, Firenze
CNR-IGG, Institute of Geosciences and Georesources, Padova
CNR-IGG, Institute of Geosciences and Georesources, Pavia
CNR-IRPI, Institute for Geo-Hydrological Protection, Padova
CNR ISAC, Bologna
CNR-IRSA, Water Research Institute, Bari
ENEA - SSPT, Department for Sustainability, La Spezia
NAF - Osservatorio Astronomico di Padova (OAPD), Padova
INAF - Istituto di Astrofisica e Planetologia Spaziali (IAPS), Rome

INGV - National Institute of Geophysics and Volcanology, Rome
INGV - National Institute of Geophysics and Volcanology, Bologna
ITT - Centre for Cultural Heritage Technology, Venice
IUSS, Pavia
OGS - National Institute Experimental Geophysical observatory, Trieste
Regione del Veneto
Soprintendenza Archeologica di Verona
Soprintendenza dei Beni culturali ed ambientali di Palermo
MUSE, Museo geologico delle Dolomiti di Predazzo, Trento
Museo di Storia Naturale di Verona
Museo Regionale della Sicilia – Galleria di Palazzo Abatellis
Centro Studi Sudanesi e Sub-Sahariani, Treviso
Eni SpA
MAPEI Spa, Milan
Geomatics Research & Development (GReD) srl, Italia
CIMA Research Foundation, Savona

EUROPE

Austria, Technical University of Vienna
Austria, University of Vienna
Belgium, Royal Belgian Institute for Space Aeronomy (BIRA-IASB)
Czech Republic, Czech Advanced Technology and Research Institute
Denmark, University of Copenhagen
France, BioSP, INRAE, Avignon
France, Institut de Physique du Globe, Paris
France, Université Bourgogne Franche-Comté, Laboratoire Biogéosciences
France, Université de Bretagne Occidentale
France, Université Sorbonne, Institut des Sciences de la Terre de Paris
France, Université Claude Bernard Lyon 1
France, CNRS/Université de Strasbourg, Laboratoire Image Ville Environnement (UMR 7362)
France, UFR Sciences of Nantes and Angers, Laboratory of Planetology and Geosciences
Georgia, Janelidze Institute of Geology, Ivane Javakhishvili Tbilisi State University
Germany, Federal Institute for Geosciences and Natural Resources BGR
Germany, Fraunhofer Research Institution for Additive Manufacturing Technologies IAPT

Germany, German Aerospace Center DLR
Germany, Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences, Telegrafenberg
Germany, University of Aachen
Germany, University Bremen Germany,
Germany, University of Bonn
Germany, Friedrich Alexander University Erlangen Nuernberg, GeoZentrum
Germany, University of Frankfurt
Germany, University of Göttingen, Department Physical Geography
Germany, Westfaelische Wilhelms-Universitaet Muenster, Institut für Planetologie
Germany, Deutsches Zentrum für Luft- und Raumfahrt DLR
Germany. Deutscher Wetterdienst (DWD)
Greece, School of Rural & Surveying Engineering, National Technical University of Athens, Athens
Greece, Centre for Renewable Energy Sources and Saving (CRES), Athens
Hungary, Eötvös Loránd University, Budapest, Fac. of Science Lithosphere Fluid Research Lab, Res. and Industrial Relations Center
Hungary, Hungarian Natural History Museum, Budapest, Department of Palaeontology and Geology
Ireland, Trinity College Dublin, Department of Geology
Luxembourg, Musée National d'Histoire Naturelle
Norway, University of Oslo, Centre for Earth Evolution and Dynamics
Norway, Oslo Metropolitan University, Department of Civil Engineering and Energy Technology
Poland, Centrum Badań Kosmicznych Polskiej Akademii Nauk, Space Research Centre
Romania, University of Bucarest
Spain, Universitat Autònoma de Barcelona, Departament of Geology
Spain, Universidad Carlos III de Madrid
Spain, University of Granada, Department of Mineralogy and Petrology
Spain, University of Granada, Department of Mechanics, Structures and Hydraulics
Spain, Universitat Politecnica de Valencia
Spain, University of Zaragoza
Spain, Tecnalia Research & Innovation
Sweden, Uppsala University, Department of Earth Sciences
Switzerland, ETHZ, Zurich
Switzerland, University of Lausanne
Switzerland, WSL Institute for Snow and Avalanche Research SLF, Davos
The Netherlands, University of Twente, Faculty of ITC
The Netherlands, TU Delft
The Netherlands, Utrecht University
UK, University of Aberdeen, Department of Geography and Environment

UK, University of Bristol, School of Chemistry, Organic Geochemistry Unit
UK, University of Durham
UK, University of Durham, Geography Department
UK, University of Glasgow
UK, University of Lancaster
UK, University of Leeds, School of Earth and Environment
UK, University College of London UCL, Institute of Archaeology
UK, University College of London UCL, Earth Science Department
UK, University of Newcastle upon Tyne, School of History Classics and Archaeology

GLOBAL

Australia, Australian National University, Research School of Earth Sciences, Canberra
Australia, Curtin University, School of Earth and Planetary Science, Perth
Australia, Macquarie University, Department of Earth and Environmental Sciences, Sidney
Australia, Queensland University of Technology
Australia, University of Adelaide, Department of Earth Sciences
Australia, University of Melbourne
Australia, The University of Western Australia, Oceans Graduate School & Oceans Institute, Perth
Australia, ARC Centre of Excellence in Coral Reef Studies, Perth
Canada, University of Alberta, Department of Earth and Atmospheric Sciences, Edmonton
Canada, University of Victoria, School of Earth and Ocean Sciences, Victoria
Canada, Polytechnique Montréal
China, China University of Geoscience, Beijing
China, China University of Geosciences, Wuhan
China, Chinese Academy of Geological Sciences, Beijing
China, Chinese Academy of Sciences, State Key Laboratory of Isotope Geochemistry, Guangzhou Institute of Geochemistry
China, China Earthquake Administration, Beijing
China, Guangzhou University, Institute of Geochemistry, State Key Laboratory of Isotope Geochemistry
China, Nanjing University
China, Northwest University of Xi'an, Department of Geology
China, Chengdu University of Technology, Institute of Sedimentary Geology
Ghana, Council for Scientific and Industrial Research, Building and Road Research Institute
India, Indian Institute of Technology, Kanpur
Iran, Art University of Isfahan, Department of Art Conservation and Archaeometry
Israel, Geological Survey of Israel, Jerusalem

Israel, Hebrew University of Jerusalem, Institute of Earth Sciences
Israel, Israel Antiquity Authority, Jerusalem
Israel, Geological Survey of Israel
Jamaica, International Seabed Authority
Japan, Kyushu University, Department of Earth & Planetary Sciences, Fukuoka
Japan, Niigata University, Faculty of Science
Japan, Senshu University
Kenya, Meru University of Science and Technology
Russia, Fersman Mineralogical Museum of the Russian Academy of Sciences, Moscow
South Korea, Kangwon National University
South Korea, Sejong University, Seoul
Turkey, Istanbul Technical University, Department Geophysical Engineering
USA Berkeley University, California, Lawrence Berkeley National Lab
USA, Brown University
USA, Getty Conservation Institute, Los Angeles
USA, Kansas State University
USA, Lawrence Berkeley National Laboratory, Berkeley, California
USA, Rutgers University, Department of Earth and Planetary Sciences, Piscataway, New Jersey
USA, Rutgers University, Department of Civil & Environmental Engineering
USA, Smithsonian Institution, National Natural History Museum, Department of Mineral Sciences
USA, University of Chicago Marine Biological Laboratory, Woods Hole
USA, University of Minnesota
USA, University of Oregon, Department of Earth Sciences
USA, University of South Carolina, Department of Geography

VISITING SCIENTISTS

Czech University of Life Sciences, Czech Republic
Department of Geology, Northwest University, China
Department of Mineralogy and Petrography, Granada University, Spain
Meru University of Science and Technology, Kenya
Texas A&M University, USA
Université de Lorraine, France
University of Adelaide, Australia

International Degree programme

INTERNATIONAL DEGREE PROGRAMME

by M. Zattin

Over the past few years, the University of Padua has spent a lot of effort on the internalization of its research and didactic activities. In this framework, in 2020 the Department launched a couple of new projects that should be able to significantly increase the number of incoming foreign students, especially regarding the master's degree courses. A very innovative agreement (named the '3+1+1 Programme') was signed with the University of Lanzhou and the Northwestern University of Xi'an. The above-mentioned programme will offer the opportunity for 10 students who have completed the first three years curriculum of undergraduate level courses to spend up to one academic year at the University of Padua as exchange students, attending course units within the Geology and Technical Geology second cycle degree course. At the end of the first year as exchange students, selected students may apply to pursue their studies as degree-seeking students within the Geology and Technical Geology degree course, following an evaluation by the academic board responsible for the regular admission. The first four students from the University of Lanzhou were enrolled in 2020 and are currently completing their MSc. Due to the pandemic crisis, only one student enrolled in 2022 but the recent new regulations in China about travelling give hope for a renewed interest in the program. A further agreement has been signed with Goethe University of Frankfurt with the specific aim to implement a two-year International Master Programme in Geosciences. The proposed programme (named 'Earth Dynamics') will consist of a first year at the home university, the third semester spent at the host university and a jointly supervised master's project in the fourth semester. Upon successful completion of the International Master Programme, students shall be awarded a degree by their respective home university. The main objective is to train students in the field of geosciences with a multidisciplinary approach and focus on active and fossil orogeneses and coupling processes from mantle to atmosphere. Moreover, it aims to endow students with the ability to tackle advanced problems using state-of-the-art theoretical and analytical tools. Students will benefit from a specific grant given by the Department that will supplement the ERASMUS+ mobility programme.

Seminars

SEMINARS *By A. Fontana*

The Dept. organizes several specific seminars along the semesters and they are mainly dedicated to master and PhD students, grant holders, but also open to the members of the Dept. and external people. Generally the speakers are selected among scholars that are a reference for their field of investigations and present the state of the art of a discipline. A major goal is also to introduce the audience to the new tendencies and future perspectives in that multiple branches of Geosciences. Some of the seminars are also devoted to show the students their possible future career, spacing between geologists and geoscientists working as employees or consultants for private companies, industries and public administrations.

In 2023 all the meetings were in presence and most part of them in English, allowing the students and in general the audience to directly interact with the speakers. Seminars were planned in the Tuesday afternoon during the first semester and in Thursday during the second one. Generally the speaker gives a presentation of about 45 minutes and 10 to 15 minutes for question & answer time were available.

DATE	SPEAKER	AFFILIATION	TITLE
07/03	Laura Ermert	ETH, Swiss Seismological Service, Zürich (CH)	Tiny shakes: utilizing and modeling ambient seismic noise and induced seismic sequences
21/03	Enrico Marcolongo	San Benedetto Acque, Scorzè (Italy)	Il ruolo del geologo in una società multinazionale delle acque
28/03	Marco Herwegh	University of Bern (CH)	Basement inversion of the European passive continental margin during Alpine collision: From nm-scale deformation processes to geodynamics
04/04	Renata Meneguolo	Equinor, Stavanger (Norway)	Northern Lights" and the role of subsurface in Carbon Capture and Storage
17/04	Patrice Carbonneau	Durham University (UK)	Global analysis of rivers with deep learning
02/05	Joseph Mwiti Marangu	Meru University of Science and Technology (Kenya)	Towards Resilient Infrastructure": A Clay Recipe for Treatment of Expansive Soils in Construction
03/05	Fabio Ferri	EIT Raw Materials CLC South, Rome (Italy)	Securing critical raw materials for the twin green and digital transition
16/05	Juergen Schieber	Indiana State University (USA)	New horizons in shale sedimentology - How experimental advances allow a new look at the rock record
23/05	Andrea Sottani	Sinergeo, Vicenza (Italy)	Il tempo nella pratica idrogeologica quantitativa
06/06	Alessandro Mondini	CNR-IRPI, Istituto di Ricerca per la Protezione Idrogeologica (Italy)	Rainfall induced landslide prediction at regional scales
06/06	Davide Elmo	University of British Columbia (Canada)	Engineering and geology: the problem of transforming qualities into quantities
05/10	Katinka Bellomo	Politecnico di Torino (Italy)	Unveiling the Ocean's influence on future climate change impacts
19/10	Alessio Bonetto	Gruppo Veritas S.p.a, Venice (Italy)	Le applicazioni della Geologia nei Servizi Ambientali
26/10	Tommaso Tacchetto	Curtin University, Australia	A multiscale approach to fluid-rock interaction processes from Earth's depth to the surface
09/11	Chris Yakymchuk	University of Waterloo (Canada)	Early life, ancient impacts, and tectonics: insights from the Akia Terrane of southwest Greenland

Orientation and Tutoring

ORIENTATION AND TUTORING *by A. Breda*

The school-university transition represents a decisive moment in the life of a student. The choice of the degree program is a decision which should be taken carefully, as it will affect his/her whole life. At the same time, the beginning of university life is the time a student reach autonomy and independence, but like many situations of transition and growth, it can bring uncertainties and/or difficulties. In this context, the peer-to-peer approach is particularly successful. For this reason, the Department of Geosciences selects students enrolled in master's degrees and doctoral degrees for tutoring activities. Tutors act as facilitators and mediators and they receive special training so that they can perform their role effectively. Tutorial activities include both teaching tutoring in particularly critical first-year bachelor's degree subjects (Maths, Physics and Chemistry), and informative tutoring, providing organizational support to first-year students, international students and dual career "student-athletes", as well as informative support in guidance initiatives addressed to high-school seniors who must choose their bachelor's degree program.

During the 2023 spring term, the Department of Geosciences participated to the orientation days proposed by the University of Padova both for bachelor's degree programs and master's degree programs and organized a series of open days addressed to the future undergraduate students, with information activities, lab experiences and visits to the places of the Department (i.e. teaching rooms, study halls, library and laboratories). These activities, led by our tutors, increased the visibility of our bachelor's degree programs and had a notable success.

During the 2023 fall term, in the frame of the PNRR funds, orientation activities addressed to high-school students have been conducted also by the faculty staff, with thematic seminars as well as lab and field experiences.

Teaching

BACHELOR'S DEGREE IN GEOLOGICAL SCIENCES
MASTER'S DEGREES IN ENVIRONMENTAL GEOLOGY AND EARTH DYNAMICS

by P. Mozzi

The professorial and research faculty of the Department of Geosciences covers a wide array of topics, ranging from paleontology and stratigraphy to sedimentology, structural geology, geomorphology, physical geography, engineering geology, mineralogy, petrology, geochemistry, georesources, planetary geology and geophysics of the solid Earth and the atmosphere. Faculty members are active scientists in their field of expertise and their effort is to transfer groundbreaking scientific and professional knowledge and skills to students. This allows the department to offer a thorough, high-standard education cycle in the geosciences, entirely hosted in a modern and comfortable building where classrooms are adjacent to laboratories and research facilities. In Academic Year 2023/2024, 197 students are enrolled in the Bachelor's Degree (Laurea Triennale) in Geological Sciences and 69 students in the Master's Degrees in Environmental Geology and Earth Dynamics.

The Bachelor's Degree in Geological Sciences provides sound basis for understanding the main processes that control the evolution of the deep Earth as well as the Earth's surface dynamics. Particular attention is devoted to field activities and laboratories, in order to provide students with challenging, hands-on experience. The aim is to allow the students to develop specific expertise in the observation and monitoring of geological processes, in geological mapping and in the analysis of rocks and minerals, challenging them to develop autonomous critical thinking. Students participate in several field trips and two field camps at the end of the second and third years, each lasting 7 – 10 days, in selected sites in Italy and abroad.

The Master's Degree in Environmental Geology and Earth Dynamics represents the ideal prosecution of geological studies at UniPD. The aim of the Degree course is to form geologists who can start and develop successful professional careers as freelance geologists or in private companies, public agencies and research institutions. Highly specialized classes, field activities and laboratories introduce the students to the multi-facet application of geological techniques and modelling. The experimental thesis work and traineeship occupy the whole last semester and allow focusing on specific topics of interest in the vast realm of the geosciences.

The Master's Degree in Environmental Geology and Earth Dynamics is organized in two study tracks. Earth Dynamics study track is entirely in English and combines solid fundamental knowledge on the Earth's processes and history with the application of cutting-

edge geological techniques and data processing. Through applied research-oriented teaching, field activities and laboratories, the program offers advanced education and training in the geosciences, with a focus on diverse issues that are crucial for future society, such as the prevention and mitigation of geohazards, land planning and environmental management, climate change, the prospection and sustainable exploitation of georesources, geomaterials, cultural heritage protection, geological mapping and planetary exploration. An agreement with the Goethe University Frankfurt allows a selection of the most meritorious students to spend a semester in Frankfurt.

The study track in Geologia Applicata alla Difesa del Suolo e dell'Ambiente firmly keeps the focus on the formation of professional geologists dedicated to engineering geology, landslide monitoring and remediation, hydrogeology. This is a strategic need in Italy, given the fragility of the national territory in terms of geohazards, water resources and environmental protection. The courses of this study track focus on the most advanced techniques in data acquisition and processing, meeting the needs of evolving environmental problems and hazard prevention and protection.

To consolidate the international experience of our students and enhance their opportunities in the European and worldwide professional and research market, the Department of Geosciences is enthusiastically committed in the Erasmus+ Program and SEMP – Swiss European Mobility Program. Several grants have been available in 2022 for our best students to spend one or two semesters in a choice of European universities in Norway, Finland, Denmark, Germany, France, Poland, Hungary, Spain, and Switzerland.

The recognition of the overall effectiveness of the didactics is provided by the students' opinion of both Bachelor's and Master's programs, which in the last years has been scoring above 8 on a scale 0-10, at the top among all programs of the School of Science of the University of Padova.

MASTER'S COURSE IN GEOPHYSICS FOR NATURAL RISKS AND RESOURCES

by G. Cassiani

In October 2020, the Department activated the Master's course in Geophysics for Natural Risks and Resources. The Master has the main goal of educating professionals and researchers capable of approaching in a multi-disciplinary manner the theory and applications of physical methodologies for the exploration and characterization of the subsoil. This exploration can take place ad different spatial scales, from meters to hundreds of kilometers, with aims spanning a large number of applications and theoretical areas where the knowledge of soil and subsoil is crucial, such as: - Search for mining and energy resources; - Subsoil characterization for renewable energies such as geothermal energy; - Non-invasive techniques for civil and environmental engineering, including geotechnical applications: - Engineering geology characterization with specific attention to hillslope stability and hydrological risks in general; - Characterization for seismic risk both at global (fault presence and nature) and local (amplification mechanisms) scales; - Application to built structures, with specific reference to the historical buildings, foundations and soil-structure interactions. - Applied Geodesy to study Earth's dynamics.

The courses on offer have been selected with two goals in mind: (i) educate professionals in the geophysical sector with a wide and solid quantitative background, thus capable of accessing a number of careers in industry and research; (ii) attract students from different backgrounds and produce graduates with a fluid interaction within the international geophysical community. In order to satisfy the requirements of the job environment, three majors (albeit informal) are foreseen: (a) a computational specialization, directed towards large scale geophysical applications (e.g. 3D and 4D seismics) with a predominant role in mining and energy subsoil exploration, (b) a field specialization, with applications directed towards the management of natural resources and risks in the environmental and engineering areas, with the aim of educating independent professionals, (c) a large scale solid earth specialization, for students interested in understanding Earth as a whole and progressing mainly in a research career. The Master's course has had a growing success, from about 15 students in the first year (affected by heavy COVID restrictions) to over 35 in the second year and some 60 students enrolled in the third year. A vast majority of international students have chosen the course, coming from 30 different countries.

BACHELOR COURSE IN EARTH AND CLIMATE DYNAMICS

by F. Nestola

The Department of Geosciences started a new international Bachelor program entirely taught in English entitled “Earth and Climate Dynamics”. The bachelor provides a strong interdisciplinary advanced training in Earth System sciences based on topics covering solid Earth, oceans climate, atmosphere hydrosphere and biosphere dynamics and their related complexities using innovative teaching methods which combine in class lectures and field activities. The Bachelor’s degree in Earth and Climate Dynamics is a 3 years programme for 180 ECTS. Beyond the theoretical lectures the course is based on several field and laboratory activities, and national and international internships. The aim is to train a new generation of geoscientists with a strong interdisciplinary background ranging from basic skills in mathematics, chemistry, physics and solid Earth (mineralogy, petrology, paleontology, geomorphology, structural geology, geodynamics) to physics of the atmosphere, climatology, oceanography and ecology, analysis of data collected in situ and remotely to learn the basic knowledge for geohazard and risk analysis also based on thematic mapping.

The Bachelor program started its first year in the academic year 2023/2024 and had 43 students (35 international students from over 20 world countries and 8 Italians). This new Bachelor represents a unicity in Italy and in collaboration with the Bachelor program in Geological Sciences complete a very wide teaching offer from our Department also at the Bachelor level.

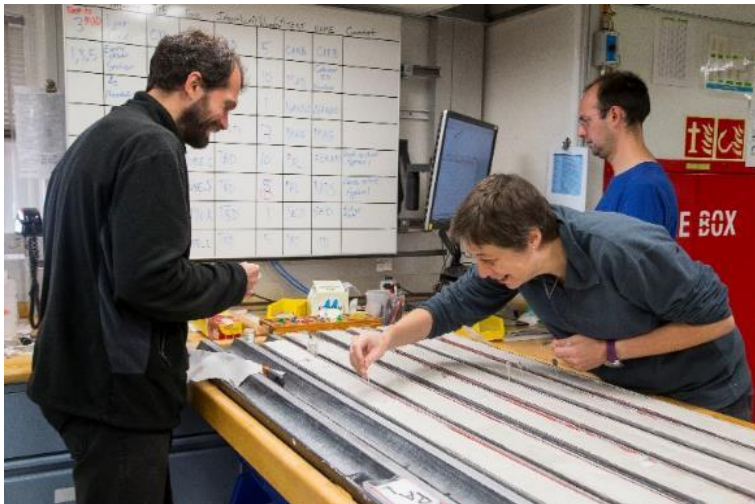
What we do

UNRAVELLING THE SECRETS OF PAST OCEANS

Claudia Agnini

My research interests lie in micropaleontology and paleoclimatology. I am a specialist in calcareous nannoplankton, which I use as the primary tool to build integrated age models that are essential for understanding the geological climate changes, and for comprehending not only their impact on the biosphere but also the global mechanisms that were active before, during, and after extreme climate events. These dramatic perturbations represent unique experiments that cannot be reproduced in any scientific laboratory, as they can provide scenarios of ongoing climate changes, especially in the perspective provided in the latest IPCC report, which speaks of the urgency to secure a livable sustainable future for all.

In my research, I consider the oceans and the marine sediments deposited on seabed to be a privileged archive that is available to the scientific community thanks to the drilling, recovery, and conservation guaranteed by the IODP project, in which I am proud to have participated/continue to participate.



THE SCIENCE OF GEOMATERIALS, INDUSTRIAL PRODUCTS, AND CULTURAL HERITAGE

Gilberto Artioli

A major strategy adopted by ongoing research is the application of state-of-the-art integrated techniques to complex problems involving materials. It is often the case that complex materials and problems cannot be solved using one technique alone. Therefore, several techniques are being used to integrate and complement laboratory measurements, including advanced sources at large-scale facilities i.e. spallation neutron sources, synchrotron radiation). Applications are mainly focussed towards the following goals: (1) development and optimisation of industrial products, mostly relevant to the building and ceramics industry; (2) development of innovative stabilisation/solidification techniques involving contaminated soils; (3) CO2 storage in stable mineral products; (4) solution of materials-based problems in cultural heritage (archaeology, art history, authentication and restoration). The research group is very active and involves researchers from the Department of Geosciences, CIRCe and the affiliated departments, local CNR, and the OPIGEO spin-off. It is now a well-known reference group at the national and international levels. On the industrial side, collaborating companies include ENI SpA and Mapei SpA. On the cultural heritage side, active collaborations include the Getty Conservation Institute, the C2RMF at the Louvre, and the Israel Antiquity Authority.

ACTIVE AND PASSIVE SEISMIC FOR THE NEAR SURFACE CHARACTERIZATION AT DIFFERENT SCALES

Ilaria Barone

My research focuses on the study of seismic waves, including ambient noise, in order to characterize the subsurface. I work at different scales and on different applications, such as environmental studies, archaeological prospection and exploration of natural resources. During the last years I have been working on surface wave tomography and on the integration of active and passive measures to retrieve detailed near-surface velocity models. My late focus is on geothermal energy, and in particular on the exploration and monitoring of geothermal reservoirs.

HOT ROCKS

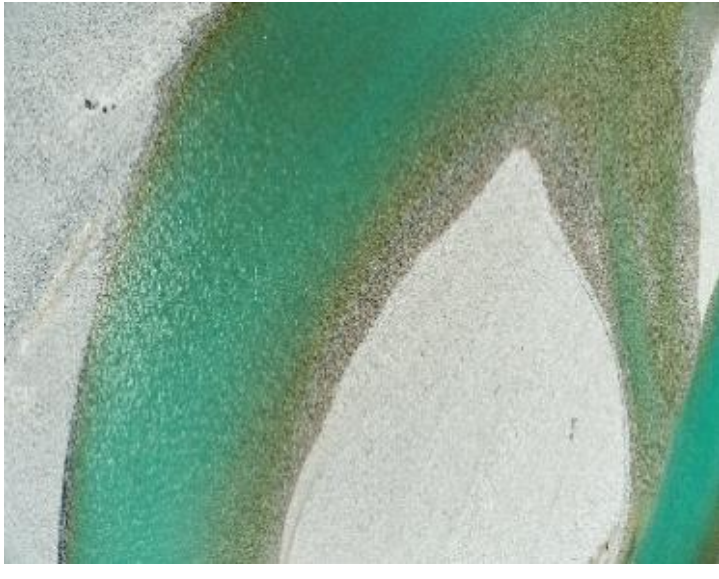
Omar Bartoli

The overall goal of my research is the investigation of mechanisms and dynamics of high-temperature processes in the deep continental crust, applying innovative methodologies to the study of crustal melting and granite petrogenesis. My research is mostly devoted to define new analytical and experimental protocols to investigate melt inclusions, providing exciting new avenues to make these small data repositories talk, obtaining a wealth of new information on melting of the orogenic crust.

RIVER MAPPING FROM SPACE

Simone Bizzi

Prof. Simone Bizzi main research interest concerns fluvial systems. Specifically, he studies the dynamical interaction of hydrological and geomorphological processes that shape the morphodynamic evolution of rivers. His research spans different countries (Italy, USA, France, UK, Australia, Vietnam), interacting with a range of research groups which has led to a multi-disciplinary approach. His principal research goal is to develop new theories concerning river behaviour that exploit novel quantitative methods, including simulation modelling, geospatial analysis, and advances in earth observation. He published several papers in the top ranked peer reviewed international journals and he is an associated editor of the journal Water Resources Research. His research has been supported by a wide range of competitive grants funded by the EU Life, FP7, 2020 programmes, the Vietnamese Government and a range of Italian Government departments.



CATCHING THE CHANGING: GEOPHYSICAL CHARACTERISATION OF A DYNAMIC EARTH

Jacopo Boaga

Applied geophysics for environment and engineering. Seismic, Electrical and electro-magnetic methods applied for extreme environments threatened by climate changes: wetlands and high mountains landforms. Low cost distributed seismic sensors for earthquake detections: seismic hazard, local response and soil building interactions.

INVESTIGATING THE ORIGIN OF HIGHLY SILICIC MAGMAS

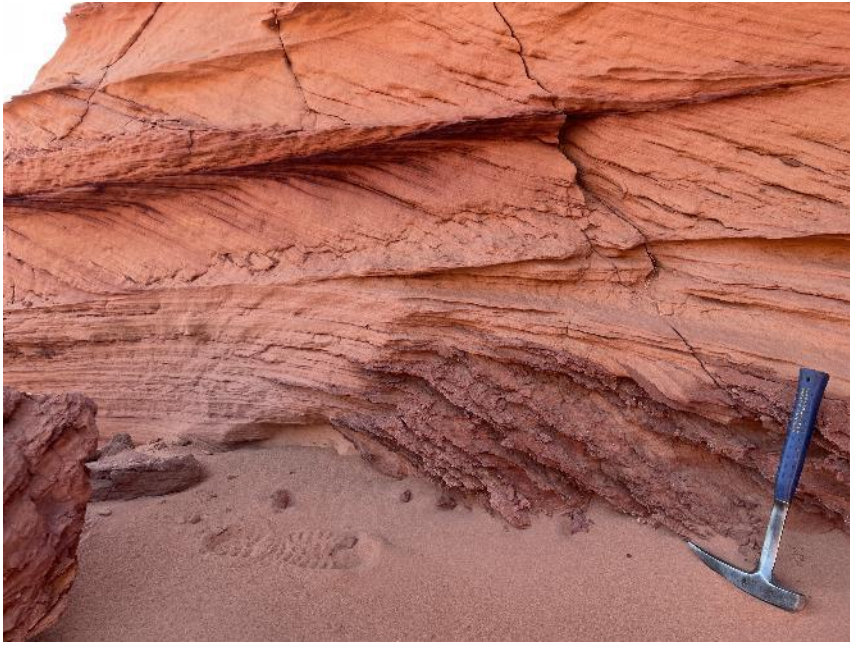
Bruna Borges Carvalho

I investigate migmatites and granulites to understand anatexis and fluid regime of the deep continental crust and their impact on granite magmatism and crustal differentiation. My main interest lies on how crustal magmas are formed and how their composition (major, trace and volatile elements) may change before segregation from the source to form granites. At the moment I am working on melt and fluid inclusions in peritectic garnet from ultrahigh temperature granulites and also on highly silicic volcanics rocks to probe their origin and volatile budget.

RECONSTRUCTING THE DEPOSITIONAL ENVIRONMENTS OF THE PAST

Anna Breda

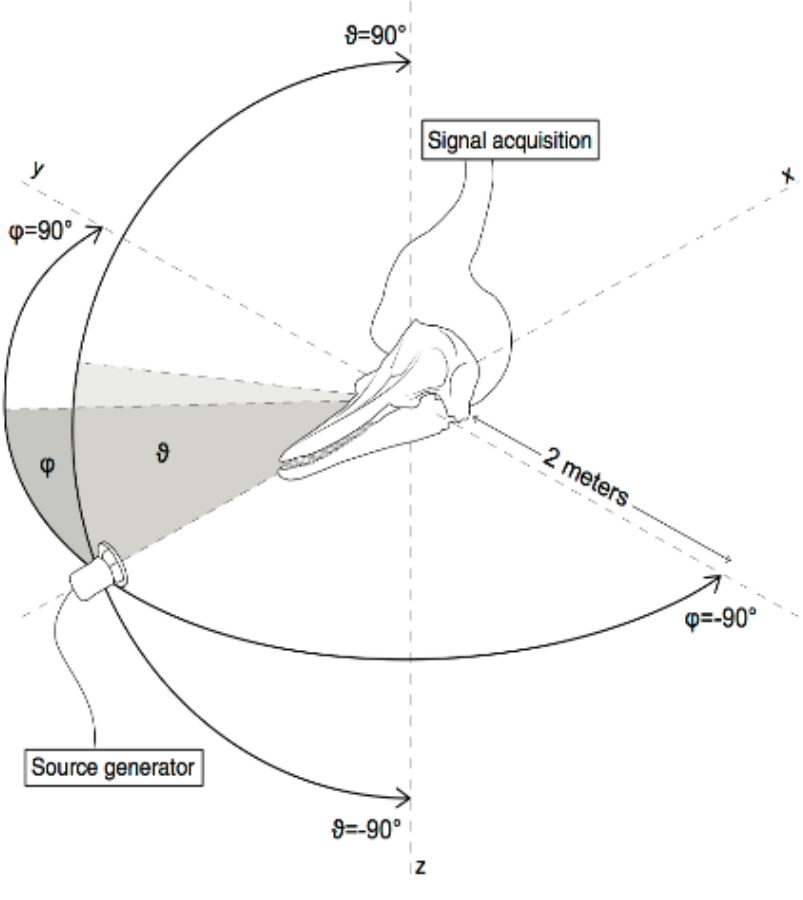
My research field is sedimentology, and I apply it in reconstructing the depositional environments of the past, based on facies analysis and sequence stratigraphic approach. My studies are strongly based on field work supported by geochemical and petrographic analysis and aim to reconstruct paleoenvironments and their evolution with time disentangling between autogenic and allogenic forcing. I'm particularly interested in coastal and shallow-marine systems as they represent the most valuable archives for the stratigraphic record of various allogenic and autogenic factors, most notably the record of relative base-level changes. To understand how global signals such as climate changes affected these settings and the related ecosystems; and to assess the role of local tectonics, reflecting wider geodynamic scenarios, in driving the sedimentary patterns and influencing the environmental conditions is for me the most inspiring thing.



SEISMOLOGY AND ACOUSTICS

Lapo Boschi

Lapo Boschi is a physicist, specialized in geophysics and seismology, who studies the propagation of waves in complex media. He applies those competences to topics in the geosciences (the structure and dynamics of the earth) and acoustics (acoustic time reversal, the dolphin's biosonar, etc.).



UNDERSTANDING FLUVIAL DYNAMICS: SEDIMENT TRANSPORT AND MORPHOLOGICAL EVOLUTION

Andrea Brenna

My research focuses on understanding the geomorphological processes that govern the dynamics of fluvial systems. A key point of my scientific approach is fieldwork, which involves geomorphological surveys, analyzing sedimentology, and monitoring ongoing processes. These efforts are complemented by the use of remote sensing data. Specifically, I employ these methodologies to investigate three main topics:(i) Sediment dynamics and the quantification of sediment transport in gravel-bed and sand-bed rivers.(ii) Understanding the relationships between anthropogenic pressures and the evolutionary trajectory of rivers.(iii) Investigating the geomorphological responses of mountain streams to high-magnitude hydrological events.The research activities I have conducted in recent years have provided contributions to our understanding of the recent evolution of rivers within the Po River Basin. Additionally, studies conducted in the Dolomite area have been instrumental in advancing our knowledge of debris flood processes and the associated geomorphological hazards.

SEDIMENTATION AND PAST CLIMATES IN THE CENTRAL MEDITERRANEAN

Luca Capraro

My research is centered on the stratigraphic and paleoclimatic study of Pliocene to Pleistocene sediments of the central Mediterranean. More specifically, I am committed in reconstructing the regional climatic evolution during the Early Pleistocene (ca. 2.6-0.8 Ma) by analyzing the expanded stratigraphic succession of recently uplifted, open-marine sediments that are spectacularly exposed along the coastlines of Southern Italy and Sicily. Our working group involves colleagues from national institutions such as the INGV of Rome, CNR-IAS, CNR-IGG, the Universities of Bologna, Catania, Chieti, Palermo, Urbino and Venezia, as well as specialists from foreign research centers such as CNRS (France), University of Missouri (USA) and Lisbon (Portugal), the Xi'an AMS center (PRC), and others. This manifold expertise allows for a multidisciplinary approach based on diverse tools such as physical stratigraphy, stable O and C isotopes, calcareous plankton biostratigraphy, paleomagnetism, and beyond.

NEAR-SURFACE GEOPHYSICS

Giorgio Cassiani

Most geological investigations face the obvious problem that soil and earth are (obviously) not transparent to visible light. Therefore, many reconstructions of the subsurface structure and processes are based on extrapolation of punctual data (from the surface or in boreholes) supported by assumptions. Luckily, exploration geophysics has long helped mankind to 'see' the subsurface for a number of practical and less practical purposes: from mining exploration to the general understanding of Earth's systems. If I had to give myself a research mission, it would be to remind all that without geophysics, there would be no sound knowledge of the earth. In particular, as the system is highly heterogeneous, as set in place by dynamic processes within the solid and fluid parts of the planet, we cannot rely upon assumptions of 'continuity', 'homogeneity' and interpolation. More specifically, my research work has been focussed, over the past 20 years, on the investigation of the structure and the dynamics of the shallow subsurface, where most engineering geology and environmental processes take place. In particular, I like: a) geophysical methods for environmental applications, with particular regard to the characterisation of hydrological systems and contaminated sites from the geological, hydrological and contamination viewpoints. The methods of choice are Electrical Resistivity Tomography (ERT) and Ground Penetrating Radar (GPR), especially in borehole and cross-borehole configuration. Novel Spectral Induced Polarisation (SIP) and microgravimetric time-lapse methods are currently under development; b) seismological micro-scale zoning and other soil dynamics use exploration geophysics, with particular reference to surface wave methods (MASW, MOPA); c) integration of hydrological modelling with evidence from geophysical methods and from classical hydrological measurements, both in the vadose zone and in the saturated zone, with the aim of calibrating the hydraulic and hydrological parameters of relevant geological formations; d) integration of invasive and non-invasive techniques for site characterisation, with particular reference to geostatistical techniques; and geomechanical issues related to the control of subsidence caused by the extraction of fluids from the subsurface, with particular regard to petrophysical and modelling aspects, including the geomechanical effects on 4D seismics.

TOWARDS GLOBAL LANDSLIDE MODELS - UPSCALING HAZARD FORECASTS IN SPACE AND TIME UNDER CLIMATE CHANGE FORCING

Filippo Catani

Landslide hazard, machine learning applied to geohazards, monitoring and modelling of basin-scale surface processes, natural hazards, applications of remote sensing to landslide studies, oil & gas environmental impact and risk, surface monitoring in open-pit mines, scaling processes in geomorphology.

PROBING THE DEEP CRUST

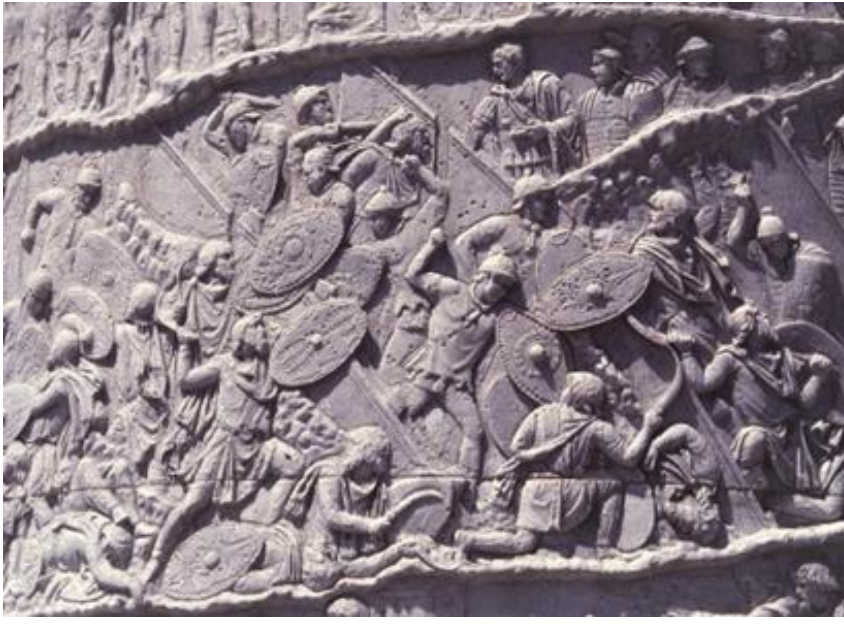
Bernardo Cesare

In the ACME (Advances in Crustal Melting) research group, including Profs O Bartoli and B Borges Carvalho and PhD candidate P Slupski, we study the how (processes) and the what (products) of partial melting of the deep crust. This is probably the main process that shapes the upper layer of our planet, which determines its geochemical differentiation and promotes its dynamic behaviour through the formation of granitic magmas. Using samples of worldwide provenance, but recently focussed on rocks from Antarctica, the Alps and the Swedish Caledonides, we apply the most innovative approach to the characterisation of natural crustal melts, i.e., the study of 'nanogranitoid' inclusions in peritectic minerals such as garnet. This novel approach, developed by our research group, utilises a series of analytical techniques ranging from conventional petrography to experimental petrology.

SUSTAINABILITY & CULTURAL HERITAGE

Chiara Coletti

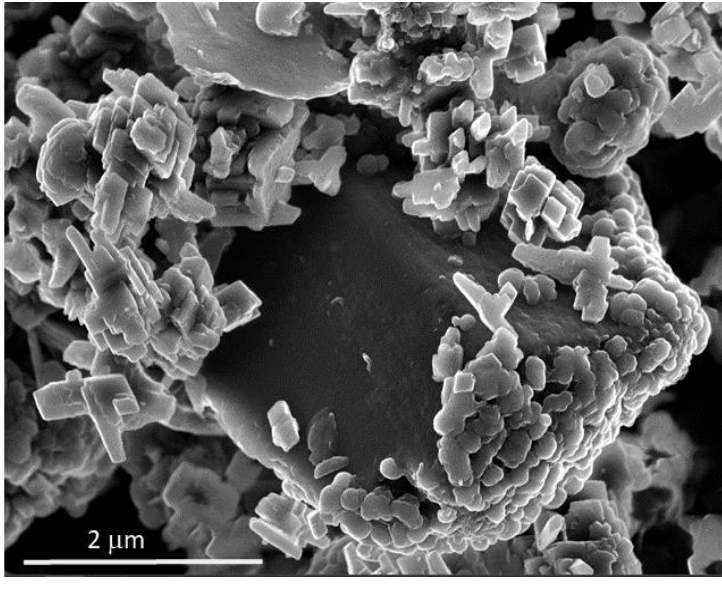
Material culture and heritage sites refer to cultural phenomena embodied in physical objects, produced by other humans in the past. Such objects, architectural elements, building materials, archaeological artifacts constitute an expression of our past culture and strongly influence our sense of identity. My studies aim to help answering the general question "How to preserve cultural identity for future generations?". They are mainly addressed to the maintenance of our stone heritage patrimony and to the production of new building materials under a sustainable vision. Currently, my main research activities include: stones deterioration and geomaterials vulnerability in indoor and outdoor climate conditions (decay products and surface changes); archaeometric studies of artifacts from Iran and Italy (provenance, uses and technological know-how); assessment of physical and mechanical properties of stones and ceramic materials; sustainable production of clay-based materials recycling waste and by-products to be used in modern and historical buildings.



MINERALOGY APPLIED TO THE STUDY OF CEMENT

Maria Chiara Dalconi

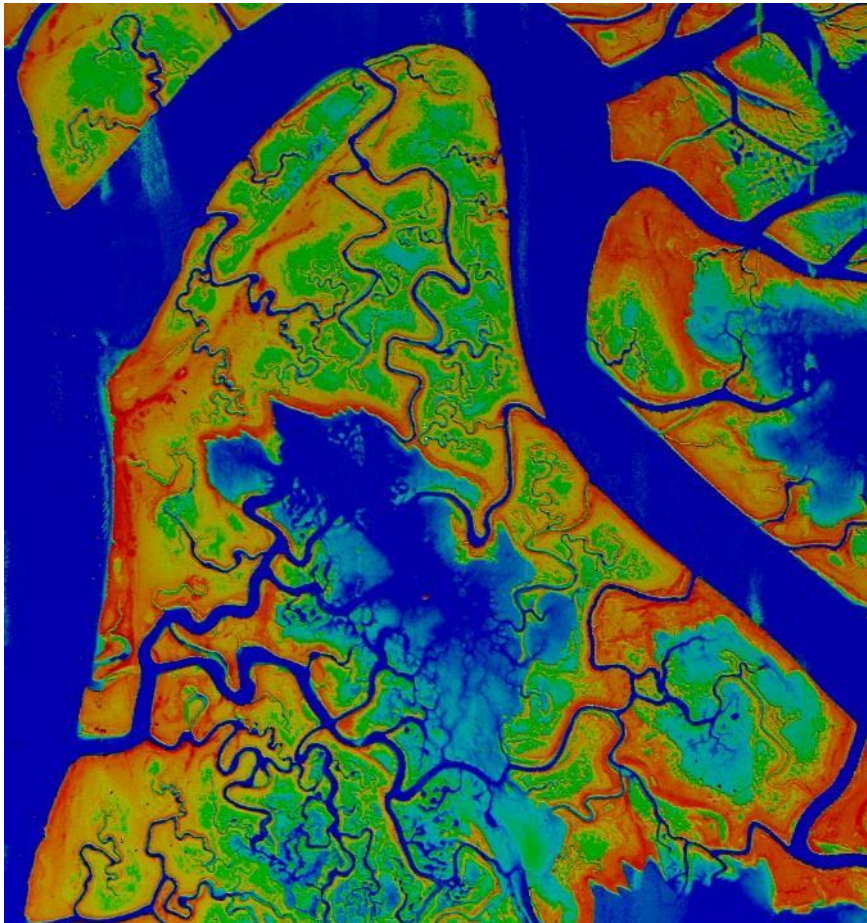
Cement is the most used industrial material, considering the enormous volumes produced and consumed yearly worldwide. It is generally considered a simple and cheap material; actually, it is a highly engineered material that has been optimised since the beginning of the 20th century. Cement is still the subject of extensive research and its technological content is increasing. The challenge of the present day is to make cement more sustainable, reducing the environmental impact related to its production. Academic research can make a valuable contribution to achieving these goals. My research activity is focussed on understanding the process involved in cement hydration, how cement composition impacts final mechanical properties, on elucidating the elusive structural details of C-S-H (the main product in hardened cement paste), and on how we can safely use industrial byproducts (waste) as cementitious materials and reduce the consumption of natural raw materials. A research activity that is feasible only thanks to collaboration with colleagues of the Geoscience Department, IGGC-CNR researchers and in cooperation with industrial partner Mapei SpA and an OPIGEO spin-off.



ESTUARINE AND FLUVIAL ECO-MORPHODYNAMICS

Andrea D'Alpaos

D'Alpaos' research focuses on the mutual interactions and adjustments between physical and biological processes in coastal landscapes. His research on the biomorphodynamic evolution of coastal landscapes includes understanding, through field observations, laboratory experiments, and modeling, how biogeomorphic feedbacks contribute to shaping these landscapes and how they drive system response to changes in the environmental forcing and human interferences.



GEOTHERMAL ENERGY AND THERMAL PROPERTIES OF ROCKS

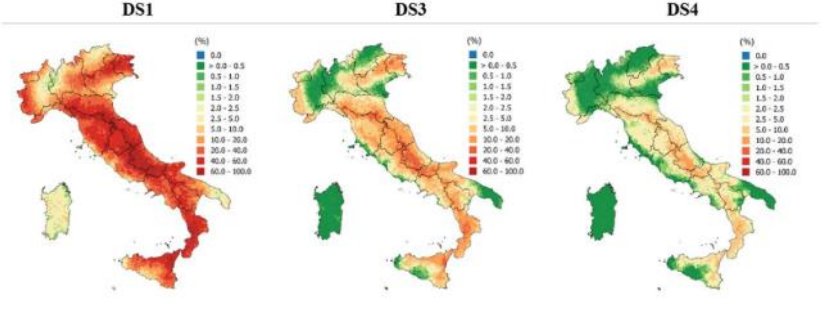
Eloisa Di Sipio

Currently, as coordinator of the European project DeepU (G.A. 101046937), "Deep U-tube heat exchanger breakthrough: combining laser and cryogenic gas for geothermal energy exploitation (DeepU)", I am leading a research field devoted to unveil the thermal effects of laser beam and cryogenic gas combined actions on different type of rocks, analyzed by petrographic and geophysical techniques. In addition, my research field concerns other topics as (i) detecting the urban thermal footprint in metropolitan and rural areas to develop a multi-scale approach for future geothermal utilization and management; (ii) the applications of non-destructive diagnostic techniques both in laboratory and on field for geothermal purposes for the thermo-physical-mechanical properties characterization of rock materials, (iii) the possibility to reuse abandoned/exhausted O&G wells for geothermal purposes, (iv) the potential and feasibility of both underground thermal energy storage systems and shallow geothermal systems.

SEISMIC VULNERABILITY OF STRUCTURES AND SEISMIC RISK

Francesca Da Porto

Earthquakes represent a major threat for the built environment and for the safety of people. My research activities focus on understanding the seismic vulnerability of structures, to propose new design procedures and develop mitigation strategies for existing constructions, in particular Cultural Heritage buildings. To this end, I carry out on-site tests with several non- and minor-destructive techniques, including tests for the dynamic identification of buildings. I use monitoring systems, both traditional on-site SHM and satellite MT-InSAR techniques, for assessing the health condition of buildings and monuments. These results are used to calibrate numerical models for the analysis of structural behavior and the assessment of seismic vulnerability. I also work on developing and evaluating the effectiveness of techniques aimed at reducing seismic vulnerability. Starting from the seismic response analyses of single and clustered buildings, I moved to the seismic vulnerability assessment of urban centres and, more recently, to the seismic risk assessment at a territorial scale. In this field, I actively contributed to the first "National Risk Assessment" delivered by the Department of Civil Protection in 2018, and I am working on the subsequent three-year updates of the same document. In my work, I have many collaborations with the DPC, as well as ReLUIS, the Ministry of Culture, and many other public administrations and private companies. I also have many collaborations with research institutions abroad, in particular in Israel and in China.



National Seismic Risk Assessment. Unconditional damage map of masonry buildings at 50 yrs.

MECHANICS OF NATURAL AND HUMAN-INDUCED EARTHQUAKES

Giulio Di Toro

Mankind has been a victim of earthquakes for millennia and is now able, often accidentally, to cause them. In my research, I study the earthquake engine (the fault zone) by conducting (1) field studies of faults exposed at the surface and of fault rocks from deep drilling projects, (2) laboratory experiments that reproduce deformation conditions during the earthquake cycle, and (3) microanalytical studies of natural and experimental fault rocks to answer the following questions

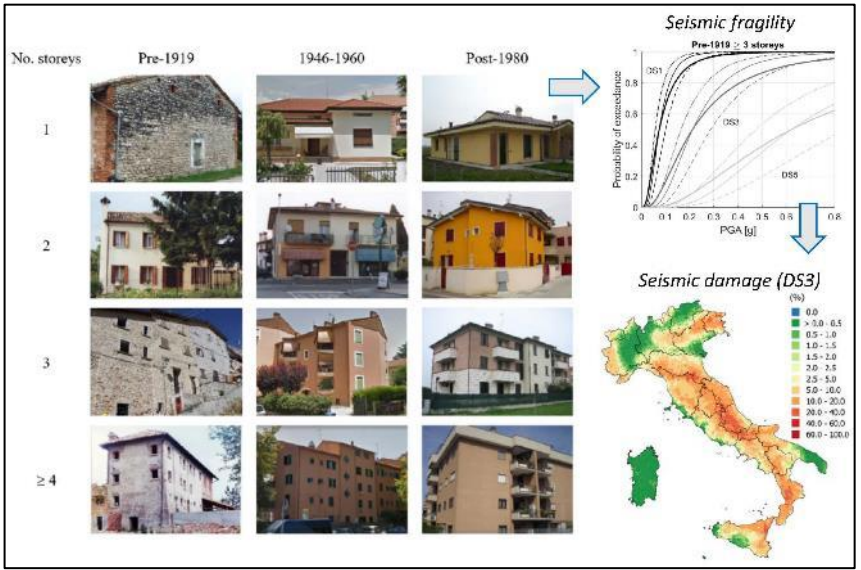
- What is the structure of a seismogenic fault?
- What are the deformation mechanisms active during the seismic cycle?
- How are seismic ruptures nucleated, propagated, and stopped?
- Why do some faults slip almost silently and others rupture in damaging earthquakes?
- Why do many earthquakes remain small and only some become large?
- How are tsunamigenic earthquakes generated?
- Why does the slow creep of a landslide evolve into a catastrophic collapse?

SEISMIC RISK ASSESSMENT AND MITIGATION OF BUILT STRUCTURES

Marco Donà

Main research interests include:

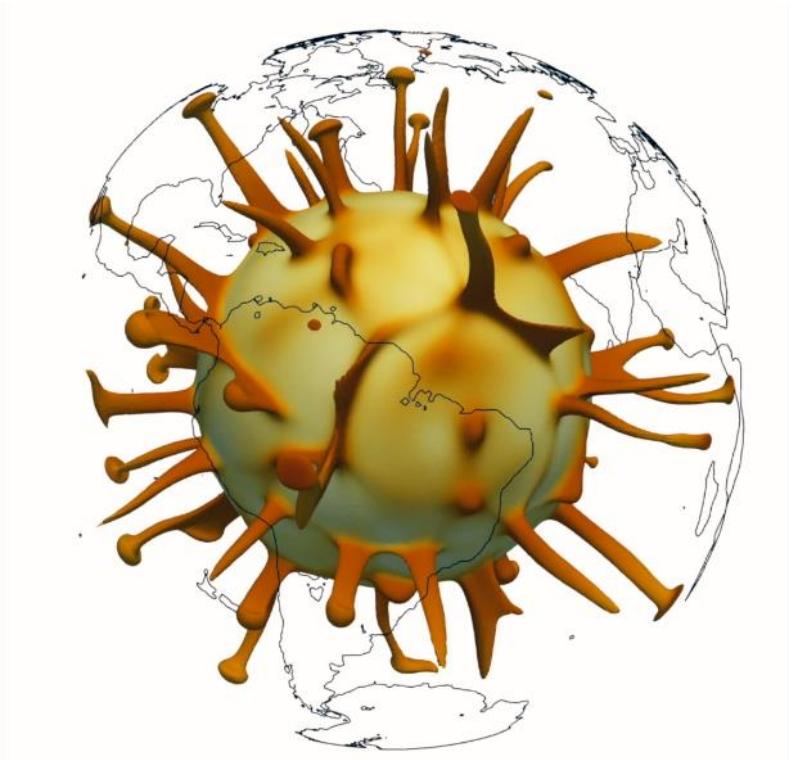
- inter-storey seismic isolation and the definition of approaches for its optimal design, particularly for seismic retrofit applications through elevation;
- new passive control techniques, based on mass damping, to mitigate seismic effects on industrial racks;
- experimental and numerical characterization of isolation systems for structural content (lightweight structures) protection;
- seismic behaviour of load-bearing masonry walls, with focus on evaluation of second-order effects;
- experimental and numerical evaluation of the seismic behavior of reinforced concrete infilled frames, and the combined in-plane and out-of-plane seismic response of various infill panels;
- definition of mechanics-based fragility models for classes of residential buildings, estimation of related seismic risk, and cost-effectiveness assessment of seismic retrofit interventions at the national scale;
- characterization of building and bridge stocks, and their prioritization based on simplified seismic vulnerability assessments.



STUDY OF THE DEEP EARTH'S INTERIOR

Manuele Faccenda

Numerical modelling of seismological, petrological, and thermo-mechanical processes, such as grain- and rock-scale structural fabrics development, regional-scale evolution of active tectonic settings, and global scale simulations of planetary interiors. Deep and long-term volatiles cycle. Seismological forward and inverse problems. Scientific software development and optimisation.



FLUVIAL AND TIDAL ECOMORPHODYNAMICS

Alvise Finotello

Combining field surveys, remote sensing analyses, numerical modeling, and physical laboratory experiments, Alvise investigates the morphodynamic evolution of tidal channels and tidal channel networks in tidally-influenced estuarine and fluvio-deltaic environments, as well as the intertwined ecogeomorphological feedbacks between tidal currents, sea-level changes, wind waves, and vegetation dynamics and their effects on the long term evolution of tidal salt-marshes. In addition, he is also interested in understanding the ecomorphodynamic evolution of meandering streamflows in distinct environmental and climatic settings - from tropical forests to deserts to Arctic environments -a relevant topic with global implications for stream and wetland restoration, land management, infrastructure design, oil exploration and production, carbon sequestration, flood-risk mitigation, and planetary paleoenvironmental reconstructions.

GEOHAZARD EVALUATION AND MITIGATION

Mario Floris

I am part of the Engineering Geology group of the Department. The group is composed by one full professor, three assistant professors, four PhD students, two visiting PhD students from China and me. In the last year, we have developed a Machine Intelligence laboratory dedicated to the analysis and assessment of geohazards using the most recent Artificial Intelligence (AI) techniques. Currently we are carrying out surveys on landslide hazard affecting the Belluno Province (NE Italian Alps), financially and technically supported by the Veneto Region, and in collaboration with researchers from the Department of Land, Environment, Agriculture and Forestry of the University of Padua and the National Research Council. We are analyzing the effects of extreme meteorological events on the variation in the susceptibility to landslides in the study area. To this end, we are performing field geological and geomorphological surveys, GIS-based landslide hazard analyses, SAR satellite data processing, detection, and characterization of landslides through Machine Learning techniques applied to high-resolution optical data. Of particular interest is the VAIA windstorm that hit the Northeast Italian Alps in 2018 and caused huge damage to environmental and anthropic elements.

Due to recent climate changes, this kind of dangerous phenomena seems to have become more frequent in the last year, therefore great attention must be paid to the short- and long-term effects on the stability of slopes and, consequently, on the elements at risk, such as anthropic structures and infrastructures. Our group is establishing and consolidating relationships with numerous foreign academic and governmental institutions located in Europe, Central America, and East Asia, to realize a scientific network dedicated to geohazard risk assessment and mitigation, and to explore the possibility of finding common strategies and solutions for human resilience at a global level, within a climate change context.

THE INTERNAL STRUCTURE AND MECHANICAL PROPERTIES OF SEISMOGENIC FAULT ZONES: FROM THE FIELD TO THE LABORATORY SCALE

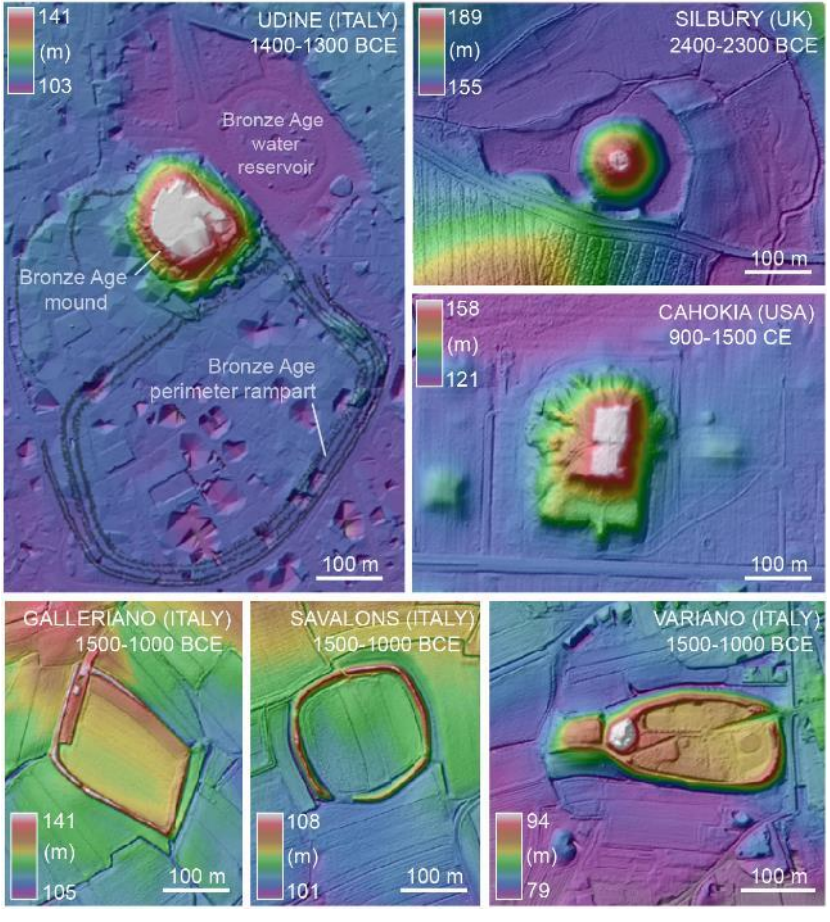
Michele Fondriest

My research focus is the study of the internal structure and mechanics of fault zones. I tackled this topic at first, as structural geologist, based on robust field structural surveys of exhumed fault zones and microanalytical studies of natural fault zone rocks. I also conduct rock-deformation experiments to investigate the mechanical behavior of rocks under a wide range of ambient and loading conditions. More recently, I have begun to study (i) fluid rock-interaction and fluid-flow within fractured rocks, and (ii) the elastic properties of fault zone rocks at different length scales: from ultrasonic velocity measurements to near-surface seismic surveys within fault zones.

QUATERNARY EVOLUTION OF ALLUVIAL AND COASTAL PLAINS BETWEEN NATURAL DYNAMICS AND ANTHROPOGENIC LANDFORMS

Alessandro Fontana

Alluvial plains represent one of the most populated environments on the Earth and the knowledge of their geomorphology and subsurface geology is of primary importance for a wise territorial managment and the sustainable future planning. Through the use of remote sensing, field survey, stratigraphic corings, geophysics and paleoenvironmental analyses it is possible to characterize the geometry and properties of the sediments and of the landforms. Along the Quaternary the major constraining factors in the evolution of alluvial and coastal plains generally are the climate changes, but a significant importance in shaping the surface of the planet was played by human societes since late Prehistory. With a geoarchaeological approach, I led the group that recently discovered that the hill of Udine (NE Italy) is an artificial hill built around 3400-3300 years ago and, with its elevation of 30 m and the volume of about 500,000 m3, is the largest prehistoric mound in Europe.



CENOZOIC AND LATE CRETACEOUS CALCAREOUS NANNOFOSSIL BIOSTRATIGRAPHY AND PALEOECOLOGY

Eliana Fornaciari

Information on past climate changes and their interactions with the Biota is vital, as it provides clues on the present and future evolution of our planet. In Earth History, a few geologically brief intervals have been identified that were characterized by anomalous high temperatures (e.g., Paleogene hyperthermal events, Late Cretaceous OAE) and may represent analogues of the current climatic stress. Understanding of their triggering mechanisms, development and recovery phases involve many disciplines of Earth Sciences. I contribute to this task via the study and quantitative counting of calcareous nannoplankton assemblages, to establish: (1) the age and timing of these "warming episodes"; (2) changes within the fossil communities in terms of abundance and biodiversity before, during and after these episodes; (3) sensitivity to dissolution and presence of heavy metals. My studies benefit from active collaborations with colleagues from others University (Urbino, Chieti, Ferrara, Modena) and Research Institutions (Italian and French CNR).

SYSTEMATIC PALAEONTOLOGY AS A KEY TO UNDERSTAND THE TRIASSIC-JURASSIC EVOLUTIONARY HISTORY OF THE WESTERN TETHYAN GASTROPODS

Roberto Gatto

My current research focuses on the taxonomy of gastropod faunas from Hettangian and Aalenian strata of continental Europe, in order to elucidate the faunal recovery in the aftermath of both end-Triassic and Lower Toarcian extinction events. I also study crinoids from Italian Paleogene deposits.

SEDIMENTOLOGY AND MORPHODYNAMICS OF FLUVIAL AND TIDAL MEANDERING CHANNELS

Massimiliano Ghinassi

My research work mainly focuses on linking morphodynamic processes of clastic depositional environments with related sedimentary products, with a particular focus on fluvial and tidal systems. I developed my background applying principles of facies analyses on outcrop exposures, and investigating sedimentary successions spanning in age from Precambrian to late Cenozoic. I recently moved my interest on modern meandering channels draining coastal areas, and on their Holocene deposits. In times of noteworthy environmental changes, management of lowland and coastal areas is tightly linked to the understanding of evolution of these sinuous channels, both to live by their side and to manage the landscape, which they chiseled over the past millennia. I currently investigate deposits of fluvial, fluvio-tidal and tidal channels through integration of remote sensing, numerical modelling and sedimentological approaches in collaboration with my colleagues Andrea D'Alpaos and Alvise Finotello. I recently started applying principles of sedimentary facies analyses to predict distribution of microplastics in riverine environments.

THE CRETACEOUS-PALEOGENE FOSSIL RECORD OF NORTHERN ITALY

Luca Giusberti

My main research field is the study of Meso-Cenozoic benthic foraminifera, which I employ as proxies of the environmental conditions at the seafloor and for paleodepth estimates. I am specifically interested in investigating the climatic and biotic perturbations of the Paleogene that are well exposed in the on-land marine successions of the northern Veneto region, such as the Cretaceous/Paleogene (K/Pg) transition, early Eocene hyperthermals, the Early Eocene Climatic Optimum (EECO) and the Middle Eocene Climatic Optimum (MECO). I am also actively involved in a multidisciplinary study of the classic Fossil-Lagerstätte of the Veneto region, such as the famous UNESCO-candidate Eocene site of Bolca (Verona province), and other fossil sites of northeastern Italy. In this context, I deal with geological and stratigraphic reconstructions as well as the nomenclatural and historical revision of the fossils found at the sites of relevance, which are mainly housed in scientific museums. My work benefits from tight collaborations with the Universities of Vienna, Modena, Ferrara and Turin, the CNR-Institute of Geosciences and Georesources of Padua, the University of Lyon and various museums in northern Italy (Natural History Museum of Verona, Natural History Museum of Venice, Museo Friulano di Storia Naturale).

PETROLOGY OF CULTURAL HERITAGE MATERIALS: DISCLOSING THEIR PROVENANCE AND THE PRODUCTION TECHNOLOGY

Lara Maritan

My research couples mineralogical, geochemical, isotopic and petrographic analysis to disclose the provenance, the production technology and the alteration state of ancient artifacts, particularly of ceramics, mortars, pigments and stones, from various regions and dated back till the Paleolithic. In addition to laboratory analyses, field activities contribute to properly sample the ancient artifacts, as well as studying the environment in which they laid down for century or millennia, or the possible geological area from which the raw materials used were supplied. The use of standard analytical procedures and the application of advanced methods (also non-conventional) to better solve specific problems, represents an important aspect of my activity, as well as to explore the limits that these methods have in archeological and history of art materials. Moreover, in order to better interpret the ancient records, experimental reproductions of past technology or alteration process in laboratory, under controlled conditions, are fundamental.

HYDROMETEOROLOGICAL EXTREMES AND HAZARDS

Francesco Marra

My research interests lie in the interface between atmospheric processes, climate and global change, hydrology, and geomorphology. I combine these disciplines using state-of-the-art observational datasets (weather radars, satellites), model simulations, and advanced statistical approaches. I am particularly interested in the statistical description of extreme events, and I have a special focus on hydro-meteorological extremes and related hazards and geomorphic processes such as floods (including flash floods and urban floods), landslides, debris flows, droughts, windstorms, etc.

Current research topics include: identification of quantitative relations linking basic physical principles and empirical observations with the emerging statistical description of extremes; land-atmosphere interactions and feedbacks (how land use impacts precipitation on both weather and climate timescales, as well as how precipitation regimes impact geomorphology); climate change impact on extreme precipitation and the related hazards (mainly flash floods, urban floods, landslides and debris flows); compound and cascading processes and the related hazards.

ALPINE GEOLOGY

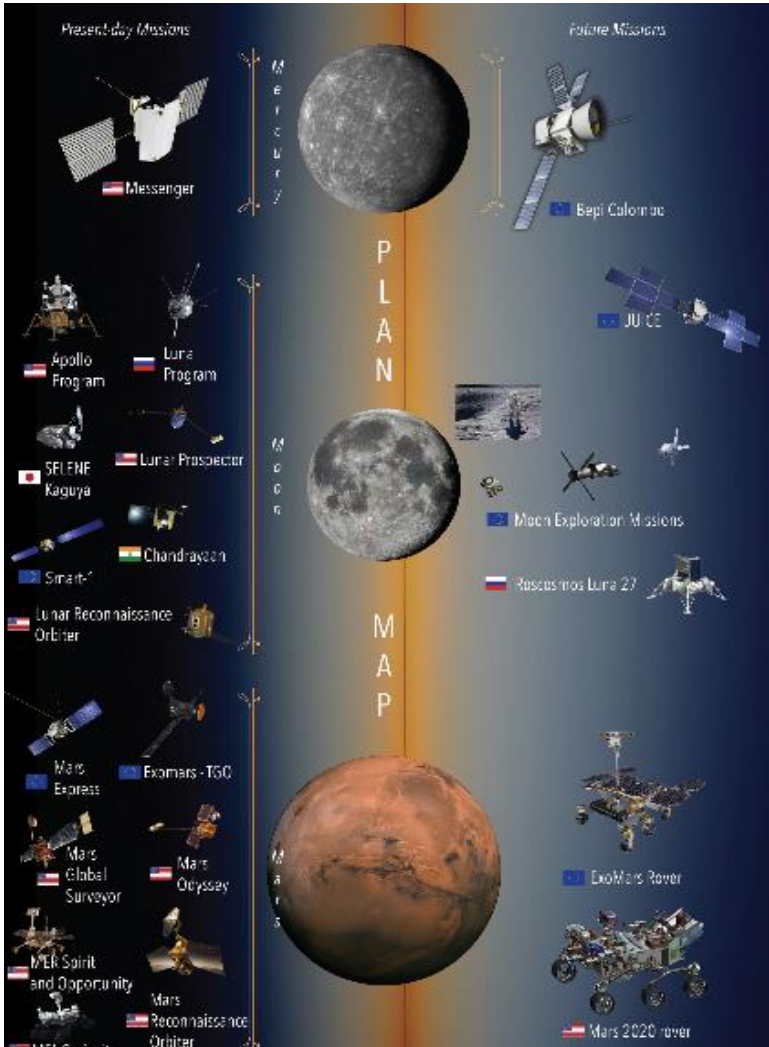
Silvana Martin

My research interest is directed to (1) mineralogical and petrological studies of the Mn mineralizations in the Western Alps; (2) geological mapping in the Alps (1:50.000 Sheet Borgo Valsugana) and (3) dating of landslides in the Brenta Group-Lake Garda region with cosmogenic ^{36}Cl isotope.

GEO-MAPPING OTHER WORLDS

Matteo Massironi

In the last years we have witnessed an exponential increase of space missions to diverse planetary bodies of the Solar System, including in situ robotic and crewed explorations led by different National Space Agencies. This trend is going to further increase in the years to come and is consequently leading to an urgency in the production of planetary geological maps to define observational strategies of orbital missions, assuring safe landing and fruitful traverses of robotic and human missions and scientifically exploiting the retrieved data. My research activity aims at producing geological maps and 3D geological models to sustain future planetary exploration on the Moon, Mars, Mercury and Jupiter's satellites. To correctly interpret the geology of planetary surfaces is, however, essential to refer to earth analogues in diverse geodynamic contexts, which are studied through field analysis, remote sensing and geomodelling.



APPLIED PETROGRAPHY IN THE STUDY OF CLIMATE CHANGE EFFECTS ON MATERIALS AND THE ENVIRONMENT

Claudio Mazzoli

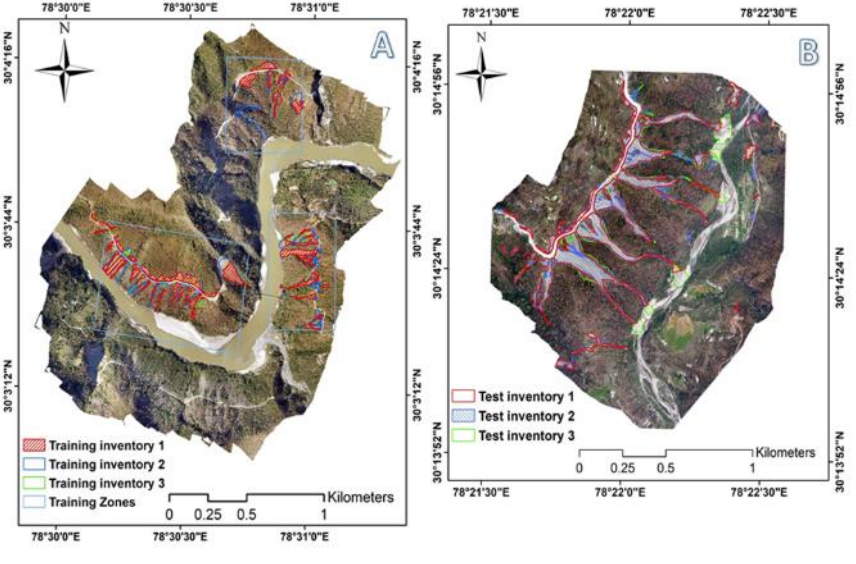
One of the major challenges in humanity is to tackle the effects of climate change through mitigation and adaptation actions and strategies. Most of us are now aware of the risks we are increasingly facing, although the effects of climate change remain somehow intangible and most noticeable impacts are still too far from our daily lives. Adequate risk management and effective policy decisions require thorough understanding of climate change, knowledge and quantifying the effects. This represents the main goal of all my research interests, which brings me from historic cities to Antarctica. My main research interest focus on understanding weathering processes and rates of decay of stones and the assessment of cultural heritage vulnerability under future climate scenarios.

APPLICATION OF ARTIFICIAL INTELLIGENCE TO LANDSLIDE RISK MANAGEMENT FRAMEWORK, FROM DATA MINING TO RISK ASSESSMENT

Sansar Raj Meena

Specialized in the use of Remote Sensing and Geographic Information Systems for natural hazard and risk assessment with focus on landslide problems. PhD in Applied Geoinformatics from Paris Lodron University of Salzburg, with research on "Rapid generation of landslide inventory and susceptibility assessment using state of the art approaches". Also, working as a visiting scientist in the department of Earth Systems Analysis, ITC and contributes to the research theme 4D-Earth, specifically to Natural Hazards and Disaster Risk Management with supervision of Prof. Dr. Cees van Westen.

Expertise in use of Artificial Intelligence and spatial information for landslide detection and hazard assessment, remote sensing and GIS for flood hazard assessment, technological hazard assessment, and multi-hazard assessment.



MANTLE EVOLUTION, DYNAMICS AND GEOCHEMISTRY; CRUSTAL GROWTH AND LITHOSPHERIC DYNAMICS

Christine Meyzen

My research builds on the isotopic and elemental composition of lavas paired with petrology in a variety of environments to gain insight into the evolution and dynamics of the Earth's mantle, mantle geochemistry, crustal growth and lithospheric dynamics. My research interests so far have focused on mantle dynamics, tectonic, hydrothermalism and magmatism in the Indian Ocean; physical and chemical interactions between mantle plumes and mid-ocean ridges and their effects on seafloor geological processes; morphology; structure, and spatial scales of magmatism at mid-ocean ridges; origin and length scale of heterogeneities in the mantle; emplacement dynamics of subaerial lava flows at oceanic islands; studies of eruption sequence and evolution of lava chemistry during volcano growth; Large Igneous Province (LIP) -forming mechanisms; origin of volcanism at isolated seamounts and rises; seafloor massive sulfide resources along mid-ocean ridges.

SYSTEMATIC PALAEONTOLOGY AS A KEY TO UNDERSTAND THE TRIASSIC-JURASSIC EVOLUTIONARY HISTORY OF THE WESTERN TETHYAN GASTROPODS

Stefano Monari

Mollusks are an important component of the past and living benthic communities with a history of evolutionary vivacity and of intense ecological diversification that makes the study of this group a good target to recognize faunal crises at a different scale and to outline the trajectories of recovery. My researches are mainly directed to identify the changes of the taxonomic and ecological diversity of the benthic mollusks of the European shelf and intra-Tethyan region during the Triassic and Jurassic. Combining these events with the changes of biogeographical distributions permits to evaluate the effect of the articulated palaeogeographical and paleoenvironmental history of the western Tethys and to frame the evolution of this group in a comprehensive geodynamical context.

DEEP EARTH, TERRESTRIAL AND EXTRATERRESTRIAL DIAMONDS

Fabrizio Nestola

My ongoing research activities mainly focus on mineral physics, diamond research, meteorites and new minerals discovery using cutting-edge analytical techniques in X-ray diffraction, micro-Raman spectroscopy, and scanning electron microscopy. My main target is the use of mineralogy and crystallography to solve geological unsolved problems at small and large scale. My main contributions are about the development of elastic geobarometry applied to the diamond-inclusion systems to determine the depth of diamond formation and to the investigation of the temporal growth relationships between diamond and its mineral inclusions with the final aim to comprehend under which geological environment diamond crystallised. More recently, I also focussed my research on meteorites and more in detail on extra-terrestrial diamonds to understand the space processes at the base of extra-terrestrial diamond formation. The research outputs in 2022 resulted in 18 peer-reviewed papers. Since one year, I am involved in a few research projects in the field of environmental mineralogy.

ARCHAEOLOGY MEETS EARTH SCIENCES

Cristiano Nicosia

I am the PI of the ERC Consolidator project 'GEODAP' (Geoarchaeology of Daily Practices), which focuses on the reconstruction of daily lives during the Bronze Age (2nd millennium BCE). The project involves an interplay of analytical techniques (soils/sediment micromorphology, palaeobotany, organic chemistry) on a set of selected archaeological sites spanning NE Italy, the Balkans, and the Carpatho-Danubian Basin. The project began in October 2021 and will last until 2026. In the framework of GEODAP I direct the excavations at the middle bronze age site of LA Muraiola di Povegliano (Verona, NE Italy. Since 2022 I am also the PI of the DIANE project (DIrt ANd Excrements), funded by FARE call of the Italian Ministry of Research (MIUR). A new laboratory for the production of soil/sediment thin sections has been built at the Department of Geosciences. The GEODAP team consists of three PhD students, two postdocs (a palaeobotanist and an organic chemist beginning in April and October 2022 respectively) and a laboratory technician. My remaining research activity concerns bronze age pile dwellings and, more generally, wetland and peat bog geoarchaeology. I participated in a Brown University (USA) mission in Petra (Jordan) focusing on ancient agricultural terraces and to geoarchaeological campaigns in Sardinia with the same University. Since 2019, I have carried out palaeoenvironmental research in the Berici Hill area (Vicenza), and excavated the Neolithic site of Molino Casarotto in 2022.

RESOURCES FOR GEOLOGY - GEOLOGY FOR RESOURCES

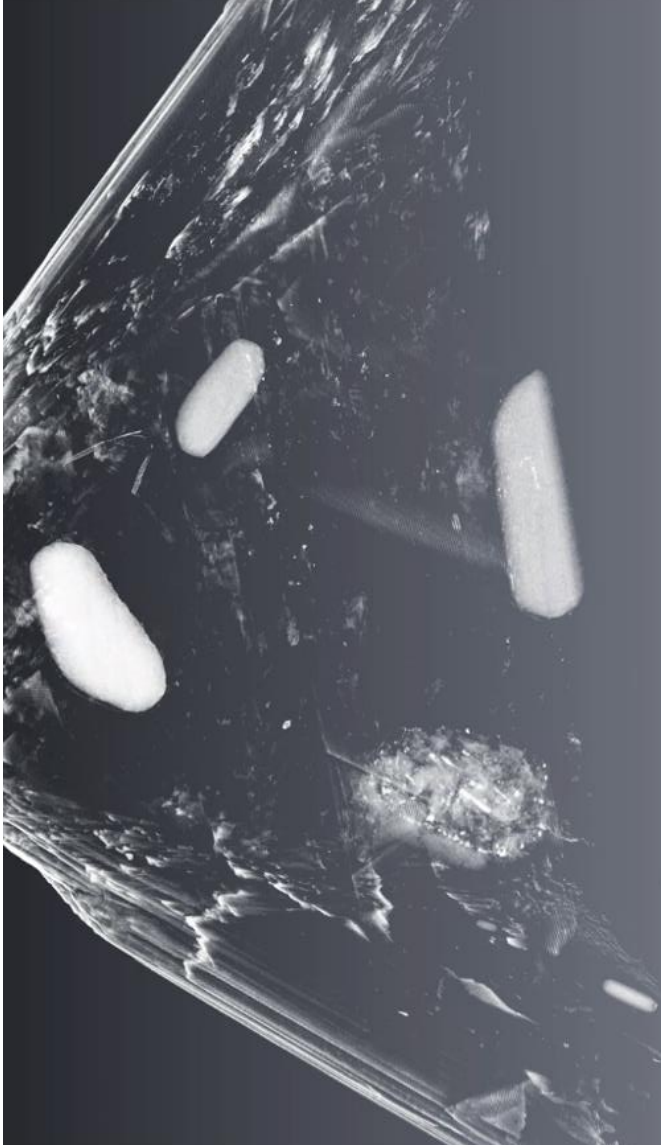
Paolo Nimis

The current activity is characterised by an interdisciplinary approach, which conjugates the themes and methods of mineralogy, ore geology, petrology and geochemistry to unravel minerogenic processes in mafic and ultramafic environments. The main recent research lines are (a) the geochemistry, mineralogy and thermobarometry of mantle rocks and inclusions in diamonds, with implications on the interpretation of the genesis and distribution of diamonds on the diamond potential of kimberlitic rocks; (b) the study of massive sulphide deposits (Cu, Zn, Co, Ni) in mafic-ultramafic complexes, with particular attention to the interpretaton of their metallogenic variability and their comparison with present-day seafloor sulfide deposits; (c) copper metallogeny and trace and isotope geochemistry of copper deposits in the Alpine belt (and neighbour areas), with archeometric implications on the provenancing of ancient copper artifacts.

DEEP EARTH GEOCHEMISTRY

Davide Novella

My research aims at improving our understanding of Earth's dynamics and evolution. I study global geochemical cycles of volatile elements (e.g., C, O, H) and stable isotopes (e.g., Fe) and their use as tracers of magmatic processes differentiating the Earth's mantle and crust. I investigate rare natural samples that form at extreme depths within the Earth's mantle, such as inclusion bearing diamonds, which offer a unique opportunity to peek into our inaccessible planet. In addition, I conduct high-pressure/high-temperature laboratory experiments to reproduce the geological processes occurring at such extreme conditions and interpret natural observations. Both approaches involve the use of state-of-the-art analytical and theoretical tools. Current research projects include: (i) the development of experimental protocols to constrain Fe isotope fractionation in the mantle, (ii) the distribution of H and C between minerals and melts in the deep Earth, and (iii) the origin and evolution of natural diamonds and their defects.



POLAR GEOLOGICAL AND LANDSCAPE EVOLUTION THROUGH AN ENHANCED GLACIAL FORCING

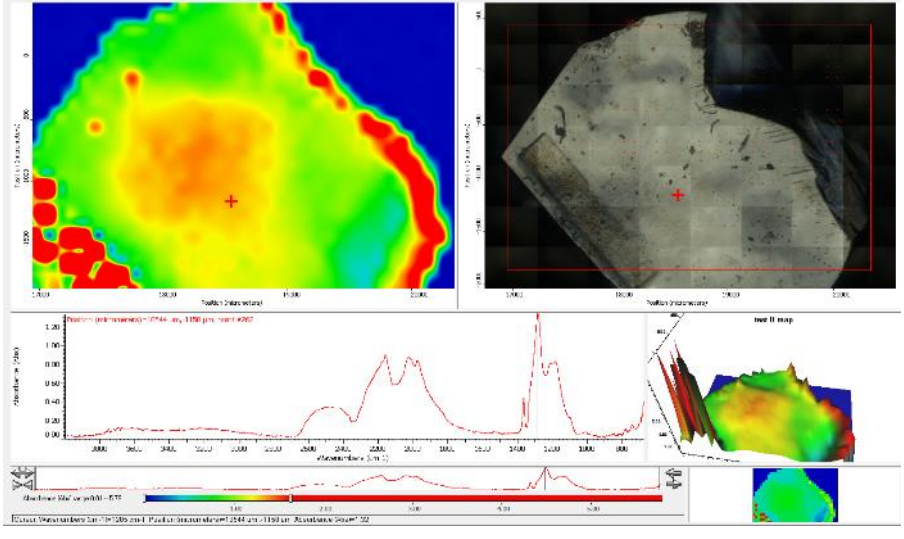
Valerio Olivetti

During the late Cenozoic, the climate of the earth recorded a constant descent towards colder condition. The consequent growth of large continental ice volumes deeply shaped the topography of high latitude and mountain regions, producing deep valleys and fjords that characterise the present polar and mountain landscape. In my research, I trace the provenance of sediment in marine sequences to detect episodes of continental ice volume changes and variation of mechanism of transport. Provenance of sediment is constrained using a multi-methodology dating that allows the location of the area of source and the elevation. Marine sediments collected in front of the Greenland coasts allowed us to detect a progressive increase in elevation of the focussed erosion, in response to increase of the periglacial erosion processes during the last 6 Myr. In Antarctica, the provenance of sediments sheds light on a glaciation event during the mid-Miocene period. Collaboration with the Trinity College laboratory of Dublin allowed us to improve the multi-methodology approach to provenance analysis consisting of a coupled fission track, U-Pb and geochemical analysis.

DIAMONDS, DEEP EARTH AND THE ORIGIN OF EARTH'S WATER

Martha Pamato

I am a mineralogist trained in mineral physics but with a wide geological background. My research goal is to determine the physical and chemical properties of Earth materials to understand the structure and composition of the Earth and its evolution into a habitable planet. My research is multidisciplinary and falls into the fields of petrology and geochemistry. I conduct laboratory experiments to simulate the conditions of the Earth's mantle, that are beyond reach. Recently, I have been applying my know-how to the study of natural samples from the very deep mantle, such as diamonds. In 2021, I obtained an ERC Starting grant for the project INHERIT, which aims to determine Earth's primordial hydrogen isotopic signature and content of a unique set of worldwide, natural diamonds dating from 3.5 to 0.09 billion years. The new results will be fundamental to pinpoint Earth's water origin with long-term implications for understanding planet habitability, in our Solar System and beyond.



UNDERSTANDING DEFORMATION PROCESSES IN THE EARTH'S INTERIOR FROM EXHUMED ROCKS - ZOOMING FROM THE REGIONAL TO THE SUB-GRAIN SCALE

Giorgio Pennacchioni

My main research interest is understanding the deformation processes occurring at depth in the earth's lithosphere. These processes include either the abrupt brittle yielding of rocks, which may cause earthquakes, or the slow creep of rocks at high temperatures flowing like highly viscous fluids. My studies are strongly based on field work and quantitative mapping of rocks tectonically exhumed to the earth's surface from deep structural levels (inaccessible to direct investigation). To understand the mechanisms at the grain/subgrain scale underneath deformation, I analyse samples using different techniques of scanning electron microscopy. Specific topics addressed in my recent research are: (i) nucleation and growth of ductile shear zones and interplay between brittle and ductile processes under metamorphic conditions, and (ii) origin of seismicity at mid-lower levels in the continental crust and of intermediate-depth subduction earthquakes in dry oceanic slabs. For the study of fossil earthquakes, I investigate unique fault rocks (pseudotachylytes) representing quenched frictional melts produced during the seismic slip of a fault. To address these topics, I work in several areas worldwide with some of the most spectacular exposures of structures, e.g. deglaciated areas of the European Alps; desert regions in the Musgrave Ranges, central Australia, and Atacama Desert in northern Chile; Lofoten Islands, Norway; Sierra Nevada cordillera, California.

RENEWABILITY ASSESSMENT OF GEOTHERMAL SYSTEMS

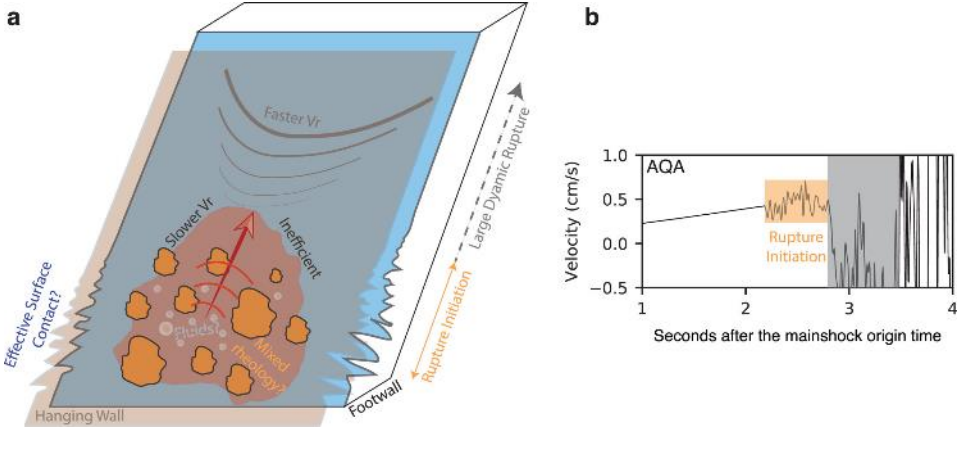
Leonardo Piccinini

Renewable natural resources are strategic in reducing greenhouse gas emissions and reducing the human footprint. The renewability of these resources is a crucial aspect that should be evaluated in the use of scenario planning. In this context, geothermal resources are one of the most profitable and environmentally friendly sources of energy supply, but their renewability is strictly related to the physical and geological processes that favour water circulation and heating. In the Veneto region, the thermal waters of the Euganean Geothermal System (EuGS) are a typical case study, and its evaluation of renewability involves the evaluation of fluid and heat recharges, regional and local geological settings, and physical processes controlling the development of the system. In particular, its renewability assessment aims to define both the importance of such components and the amount of water that can be exploited without compromising future preservation. In fact, in the second part of the twentieth century, the EuGS was threatened by server overexploitation, which caused a sharp decrease in the potentiometric level of the thermal aquifers. Consequently, a right balance between regulation and exploitation is fundamental for managing these peculiar systems. The research activities developed in recent years have been devoted to hydrogeological/geothermal characterisation and numerical simulation of the EuGS. In the former case, potentiometric surveys, pumping tests, thermal logs, and geochemical investigations were carried out with the aim of defining a conceptual geothermal/hydrogeological model. In the next step, numerical simulations of fluid flow and heat transport were based on a detailed hydrogeological reconstruction that reproduced the main regional geological heterogeneities through a 3D unstructured mesh, while a heterogeneous permeability field was used to reproduce the local fracturing of the thermal aquifers. Future goals are focussed on the downscaling of the numerical simulation from the whole system (EuGS) to the local extraction field (EuGF), with the scope of implementing a management tool for the exploitation of the thermal water.

OBSERVATIONAL SEISMOLOGY FOR EARTHQUAKES AND EARTH'S STRUCTURE

Piero Poli

I am an observational seismologist with experience in both earthquake source physics, and seismic tomography and imaging using the seismic ambient noise. My research is based on analysis of seismic data to understand the earthquake sources and the structure of the Earth. I am particularly interested in exploring seismological data to retrieve signals which can inform us about the physics of faulting deep inside the crust. In particular, I study microseismicity as swarms of earthquakes, to understand how the stress is released at plate boundary, and to resolve the fault rheology at depth. I further focus on understanding how large and devastating earthquakes start, by analysing data from a few seconds to many years before the rupture initiation. In my work I like to merge the seismological view of deformation with the geodetic one to provide a comprehensive view of the deformation budget. I am also interested in detection and analysis of exostic seismological signals generated by landslides, water or glacial movements, or human activity. Moreover, I work on utilizing ambient seismic noise, generated by human activities or oceanic storms, to provide high resolution images of the deep Earth.



CARBONATES AND PALEOCLIMATE RECONSTRUCTIONS; GEOHERITAGE

Nereo Preto

The study of carbonates can be applied to geological mapping. As the Geological Map of Italy has been funded again, I work in contributing to mapping of carbonate successions of the pre-alps.

I apply carbonate petrography and geochemistry to study the Carnian Pluvial Episode. Earth ecosystems were turned upside down some 230 Ma, but causes and effects of this episode of climate change are far from being understood. I am working especially on the disruption of carbonate depositional systems at the CPE.

Finally, there is geoheritage. A conundrum with sustainable development is to ensure economic growth, while preserving natural environments and biodiversity – but preserving geodiversity is important as well. My work on this topic involves maintaining the list of geosites of the Veneto region, other ongoing projects deal with the management of geoheritage in northern Italy.

I am managing the Isotope ratio mass spectrometer lab, along with Profs. Agnini and Rigo.

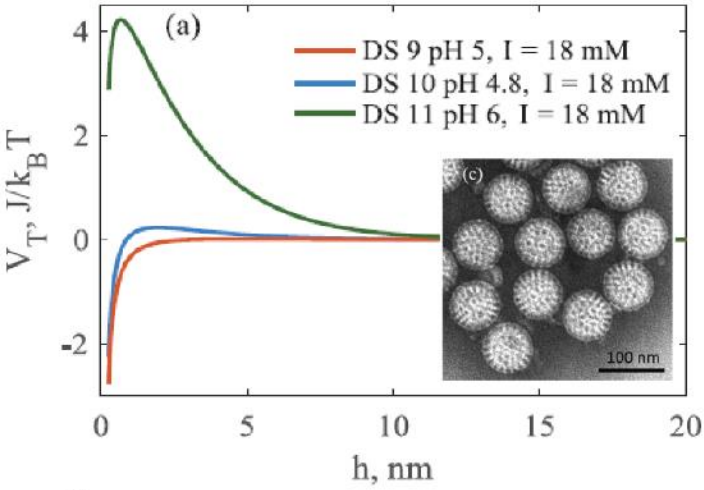
ENVIRONMENTAL PROCESS ENGINEERING

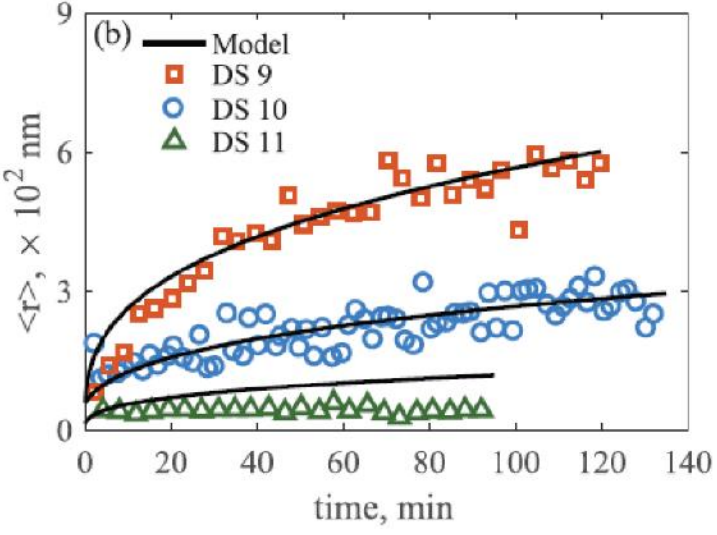
Valentina Prigiobbe

I am a geosystems and process engineer with expertise in flow and transport in reactive porousmedia, urban hydrology, and separation processes. I study complex systems with modeling and experiments across scales to: improve the prediction of contaminants migration, better forecast flooding in coastal urban areas, and enhance carbon dioxide (CO2) removal. The application of my research is within the nexus of energy and water.Currently, my research projects focus on: 1) the coupling of CO2 removal with mining of elements for the renewable energy transition (funded by USDOE); 2) the integration of hydrology models to account for aging of infrastructure in urban flooding (funded by USGS); 3) the modeling of nanoplastic particles behavior to better predict plastic transport and accumulation in soil, sediments, and surface water; and 4) the modeling of virus and bacteria transport through unsaturated porous media under variable chemical conditions (PRIN 2023).

Valentina's personal page:

https://www.geoscienze.unipd.it/en/valentina-prigiobbe





INTEGRATED STRATIGRAPHY TO DECIPHER THE EVOLUTION AND DYNAMIC OF THE PLANET EARTH

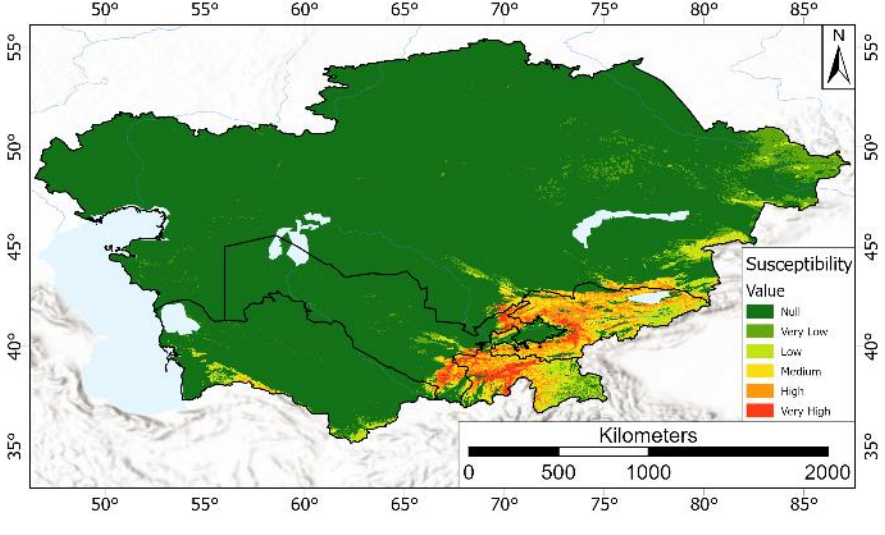
Manuel Rigo

My key areas of research interest encompass the fields of stratigraphy, geochemistry and palaeontology, including palaeoclimatology and palaeoceanography. My approach to geological problems is both field-and lab-oriented, and multidisciplinary at the same time, tackling problems in climate changes at geological timescales and the relative feedbacks in ancient biosphere, and facing early Mesozoic geochronology and palaeoreconstructions by using integrated stratigraphy and innovative methodologies. My stratigraphical, geochemical and palaeontological expertise has yielded a new understanding of the interrelationships between the role of oceanic processes in global climate change, geological processes, and biological events (extinctions, radiations and biotic turnover) during important periods in Earth history, such as early Mesozoic. I have recently focussed my studies on protracted intervals of carbon cycle instability during Late Triassic and Early Jurassic, in particular the Carnian Pluvial Event (CPE) and the late Norian to Rhaetian interval, both characterised by huge carbon isotope excursions and mass extinctions, associated with oscillations in the biological pump efficacy and/or in ocean stratification, a possible newly identified OAE. Recently, I have documented the geochemical evidence (Os and PGE) of meteorite impact events in sedimentary rocks. Other research projects employ a suite of geochemical proxies to deconvolve seawater chemistry from modern and fossil biogenic carbonate and phosphates to better understand ocean environmental change and system processes on modern and geological timescales. I also studied the isotopic composition (C and N) of early Medioeval human bones and teeth for palaeodiet investigations.

MULTI-SCALE LANDSLIDE HAZARD ASSESSMENT

Ascanio Rosi

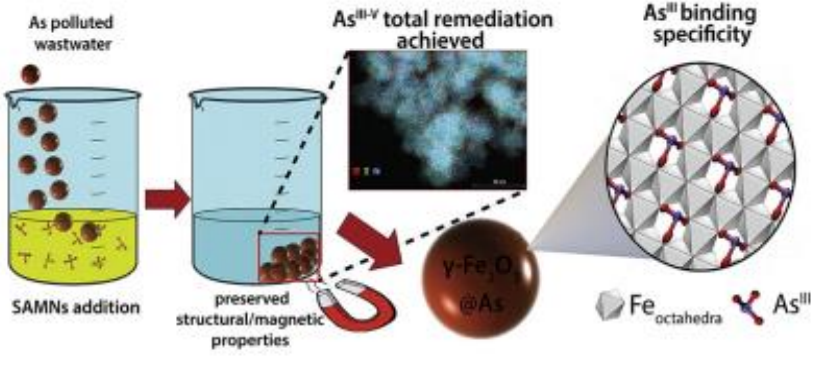
My research activities are mainly focused on landslide hazard forecasting from both a temporal and spatial points of view. I study the application of statistical approaches to the topics of my research, as well as the use of remote sensing data, artificial intelligence approaches to solve complex tasks and numerical modelling. I am part of the Machine Intelligence and Slope Stability (MISSLab) group at the Department of Geosciences, collaborating with Filippo Catani, Mario Floris, Sansar Meena and our PhD students on the evaluation of landslide hazard at different scales, by the use of different kinds of data and approaches, from GIS and numerical modelling to pattern recognition and neural networks. I'm chair associate of the UNESCO Chair on the Prevention and Sustainable Management of Geo-Hydrological Hazards, promoting new tools and approaches for landside risk reduction.



NANOMATERIALS: A KEY ROLE FOR SUSTAINABLE WATER REMEDIATION APPROACH

Gabriella Salviulo

The sustainable management of polluted groundwater is one of the most actual widespread environmental issues. The nanotechnology research has opened the way to new opportunities for the use of engineered nanomaterials aimed at rapid and effective water remediation due to the high selectivity, adsorption capacity, low toxicity and the possibility to couple remediation with the recovery and recycling of critical metals. Magnetic nanomaterials have gained interest for their high selectivity and adsorption capacity due to the possibility of easy manipulation under the influence of a magnetic field. Recent results demonstrated that a novel and green synthetic approach, followed by a deep structural and chemical characterisation, led to the implementation of naked colloidal maghemite nanoparticles for the remediation of water contaminated by heavy metals. The high performance as a sorbent material and the opportunity to magnetically recover the bound metal make this nanomaterial an attractive and economically sustainable option for moving to large-scale applications.



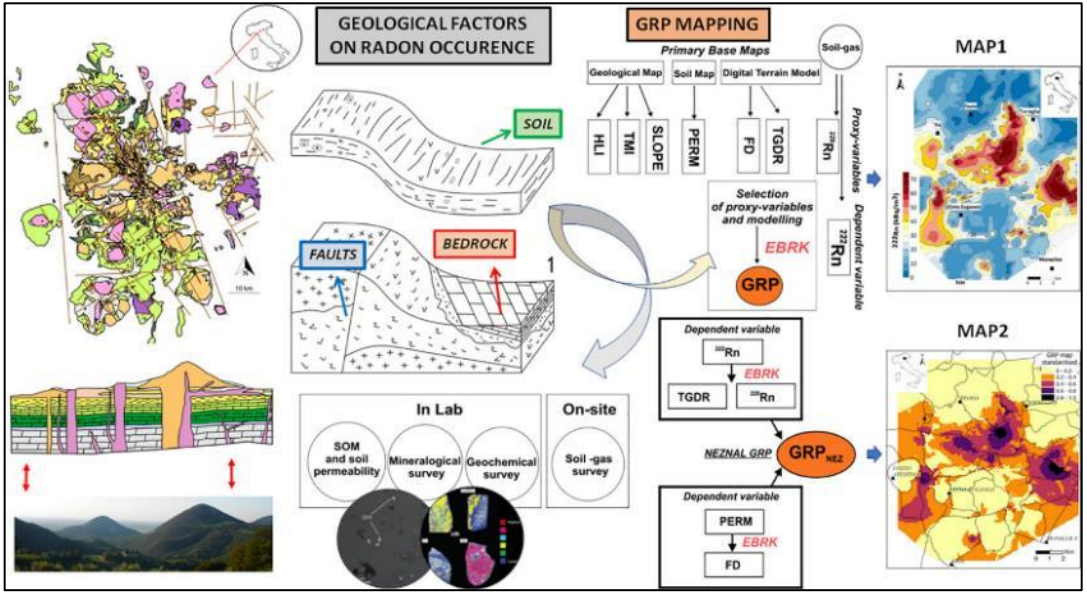
Molinari et al., 2020

RADON AND GEOLOGY

Raffaele Sassi

My research activity has developed on several topics, including petrologic studies on some south-European (Alpine-Dinaric-Carpathian) and extra-European basements, metamorphic petrology; petro-physical properties of the rocks, petrologic meaning of the chemical-physical changes of sheet silicates, applied petrography and geological mapping of crystalline basements.

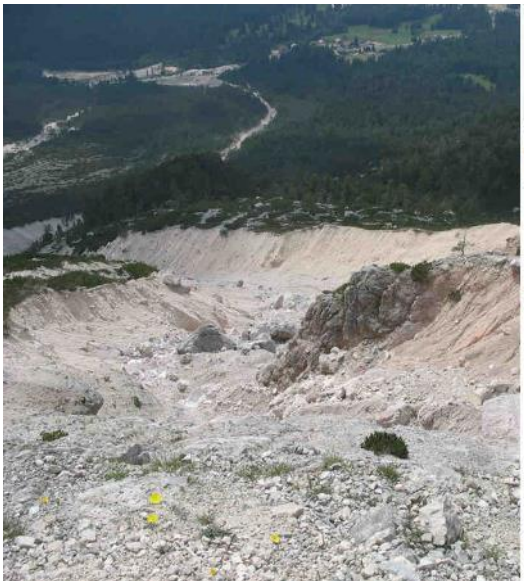
In recent years, my research has primarily focused on radon occurrence and natural radioactivity as a function of geology l.s., specifically investigating the effect of grain size on radon exhalation, the role of faults as preferential pathways for soil gases, and rock damage control on radon mobility in fault zones through an experimental approach to study radon mobility conditions.



GRANULAR MASSES DYNAMICS

Paolo Scotton

In my research activity I am dealing with (1) the study of dolomite debris flows, (2) snow avalanches and (3) low enthalpy geothermal energy. In recent years I have dedicated myself to the acquisition of rainfall data within the debris flows site of the Acquabona river (Belluno, IT) with the aim of highlighting the importance of the rainfall data survey method in the creation of reliable safety management tools. As part of the study of snow avalanches, I am working on the creation of a static penetrometer for the evaluation of the resistance to penetration of the snow cover, one of the parameters used to determine the avalanche risk. In the field of low enthalpy geothermal energy, I have designed and realized a laboratory apparatus for the determination of the thermos-physical properties of natural materials and to evaluate their interaction with geothermal probes.



ONCE UPON A GLASS: ARCHAEOMETRIC STUDIES ON A NEVER-ENDING MATERIAL

Alberta Silvestri

The research activity of Alberta Silvestri falls within mineralogical-petrographical applications for cultural heritage, with a focus on archaeometric study of glass and other vitreous materials. As ancient glass results from the melting of natural raw materials and commonly show signs of deterioration due to prolonged environmental exposure, the scientific background of Earth Sciences appears to be the most suitable to solve archaeometric problems related to source, type and provenance of raw materials, to the reconstruction of production technologies, and to alteration processes. In detail, the following research topics are carrying out by Alberta Silvestri:

a) Archaeometric characterisation of archaeological and historical-artistic glass (objects, windows, beads).

b) Archaeometric characterisation of glass mosaic tesserae and chemical-mineralogical study of the crystalline phases identified within.

c) Chemical-mineralogical characterisation of ancient glass raw materials.

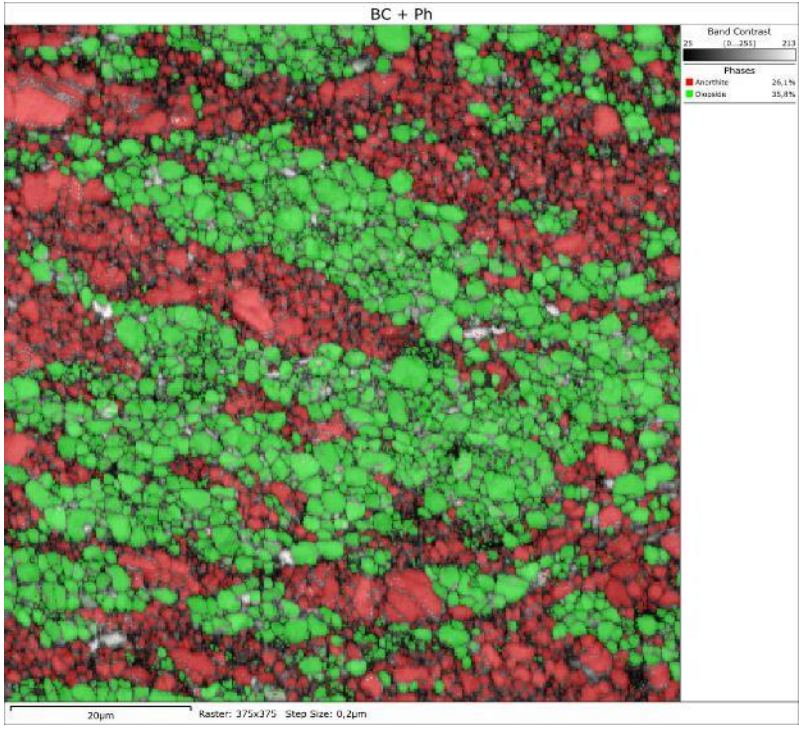
d) Geochemical-isotopic study on glass and possible raw materials.

e) Parameterization of glass alteration processes in various conservation environments.

UNDERSTANDING ROCK MICROSTRUCTURES AND EXOTIC MINERAL PHASES USING SEM BASED ANALYTICAL TECHNIQUES

Richard Spiess

My primary research activity focuses on the understanding of deformation-, recrystallisation- and growth mechanisms within rocks and rock analogues of the Earth, and of extraterrestrial material. Key point of my scientific approach is the application of SEM-based analytical techniques, and in particular EBSD analysis. The principal topics investigated during the last years span from the detection of exotic mineral phases within micro- to mini-meteorites, microstructures within diamond, thermal controlled modification of garnet inclusions, ductile deformation of granites during extensional exhumation, detection of olivine growth rates, plagioclase deformation within volcanic plumbing systems, analysis of experimentally deformed gabbro-analogues and of silicon samples, identification of the phase relationships within the upper-lower mantle transition zone within analogues produced with multi-anvil apparatus. Furthermore, I am involved in a multidisciplinary study group that has shed new light on the understanding of migmatite evolution within the granulite facies basement of the Serre Massive of Calabria.



FLOOD HAZARD AND EXTREME EVENTS IN MOUNTAIN STREAMS

Nicola Surian

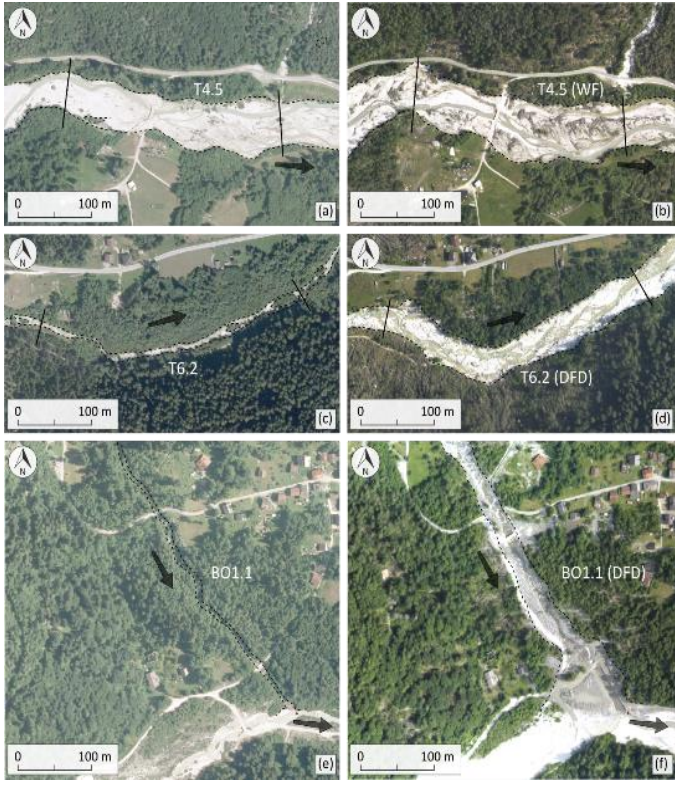
My research is focused on rivers, spanning from river processes (e.g. sediment transport) to river management (e.g. flood hazard). My main research topics are:

Floods: (i) channel response to floods of different magnitude, and in particular to extreme floods; (ii) occurrence and prediction of debris floods; (iii) hazard assessment, specifically to improve our capability of predicting geomorphic effects of floods.

Sediments: (i) estimate of bedload transport, in particular in large gravel-bed rivers; (ii) sediment dynamics and fluxes at catchment scale.

Channel adjustments: evolutionary trajectory and prediction of future scenarios, in particular in relation to human disturbances.

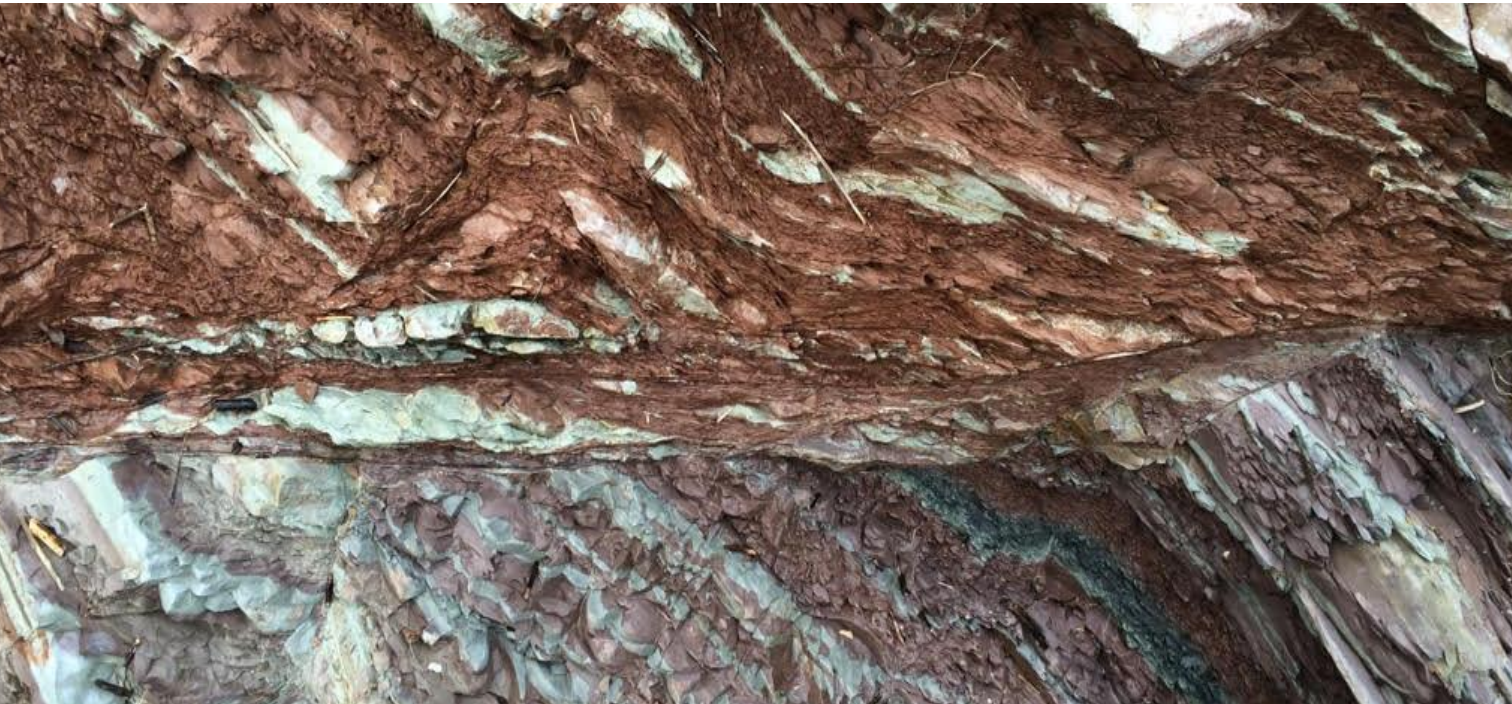
At present I am working on different rivers: mountain streams and large braided rivers in the Alps (Italy); the Po River (Italy); rivers in volcanic environment in Costa Rica.



FAULT PROCESSES AND THE SEISMIC CYCLE

Telemaco Tesei

I study the physics of earthquakes and faulting combining structural geology in the field with laboratory experiments of rock mechanics , both complemented by microscopy and analytical data. In particular, I study how fault strength evolve through the seismic cycle and how slow deformation processes may lead to rock failure. I use a combination of field observations of the structure of some major tectonic faults and laboratory friction experiments to understand the mechanical behaviour of rocks.



GEOSCIENCE FOR THE SUSTAINABLE BUILT ENVIRONMENT

Luca Valentini

"Development Minerals" are defined as "minerals and materials that are mined, processed, manufactured and used domestically in industries such as construction, manufacturing, and agriculture" (United Nations Development Minerals Programme). Such local industrial minerals will play a relevant role in those region of the world with a fast pace of demographic and urban growth, hence having a high demand for building materials, needed to sustain infrastructural and economic growth, and to provide affordable housing. Out of an overall stock of about 100 billion tonnes of materials extracted each year, such development minerals represent nearly 40% of the material flow, and they are mostly incorporated within the construction industry. From this standpoint, mineralogical sciences can play a relevant role in the deployment of strategies aimed at fostering a transition towards a sustainable supply chain in the construction sector. Locally sourced materials such as clay and carbonates of primary and secondary origin, as well as waste materials enriched is Si and Al, can be utilized for the manufacturing of mineral binders for construction, with reduced environmental footprint. A detailed knowledge of the small-scale processes at the mineral-water interface, occurring when such mineral binders are dissolved in aqueous solutions, is of fundamental importance for optimizing the cohesive properties and environmental performance of such binders.

THE DEVELOPMENT OF LANDSCAPES THROUGH THE STUDY OF NATURAL AND ANTHROPOGENIC PROCESSES: SETTLEMENT PATTERNS, HUMAN IMPACT AND ENVIRONMENTAL CHANGE

Giacomo Vinci

My research interests mainly focus on the evolution of landscapes, with a particular focus on late prehistoric periods. I developed my background applying remote sensing techniques, GIS-based spatial analyses, and fieldwork (in particular through stratigraphic excavations, corings and surveys) to investigate settlement patterns and dynamics in the past. Since my PhD and thanks to study periods and postdocs in Italy and abroad, I expanded the analysis of paleo-environments by combining the study of anthropogenic features and processes with the analysis of geomorphological landforms. Recently, I have integrated this geo-archaeological approach with the study of vegetation history and human impact, mainly based on the pollen analyses. I recently joined the Dept. of Geosciences at Padua and currently investigate the long-term interaction between humans and environments in the coastal sector of the northern Adriatic in collaboration with my colleagues Alessandro Fontana, Paolo Mozzi and Cristiano Nicosia.

SOCIETAL IMPORTANCE OF FAULTS

Dario Zampieri

Faults are intriguing structures representing challenges associated with several practical issues, such as fluid migrations in the brittle crust leading to mineral deposition, oil and gas trapping and hot water surface spill. They also control slope stability and its suitability for waste repositories and tunnel operations. Active faults are closely associated with earthquakes and seismic hazards. Although faults are usually portrayed on geological maps and sections as single lines, in detail, they are complex structures. Typically, they consist of a volume of rocks containing several structural elements and they are segmented with various geometric arrangements, producing local contraction or extension zones. In populated areas such as the Veneto plain and Fore-Alpine valleys, the study of the subsurface structural setting and of palaeo- and active faults is therefore essential. Any infrastructural design can not regardless the accurate assessment of the subsurface faults. Therefore, faults have economic and societal significance. The study of these structures is conducted in cooperation with the INGV (Rome) to upgrade the database of Italian seismogenic sources (DISS). Cooperation with hydrogeologists and geophysicists is devoted to improving the knowledge of the potentiality of the fault-controlled EuGS.

MOUNTAIN BUILDING AND CLIMATE CHANGE

Massimiliano Zattin

Several studies in the past few years support the idea of strong feedback between the growth of mountain ranges and spatial and temporal variations in climate. More specifically, mountain building in cordilleran-type orogens like the Andes is controlled by various processes that include (i) continental shortening, (ii) accretion of oceanic materials, (iii) dynamic topography, (v) crustal weakening and deformation related to mantle plumes, (vi) forearc coastal uplift due to co-seismic and post-seismic lithospheric stretching, and (vii) isostatic rebound related to the retirement of ice masses. This line of my research aims to study different sectors of the Andes through the integration of different methodologies such as structural geology, tectonic geomorphology, low temperature thermochronology, and thermal and geodynamic modelling. The interdisciplinary research group involves PhD students and researchers from Italy, France and Latino-American countries. The work is based on annual field campaigns and laboratory activities.

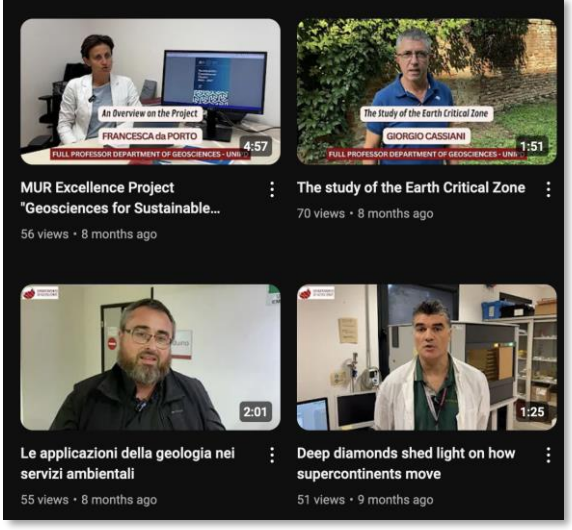
Dissemination and outreach

DISSEMINATION & OUTREACH *by J. Boaga*

The Department of Geosciences is always actively committed in promoting and offering dissemination and divulgation of the scientific knowledge. It is nowadays agreed that a pervasive and effective outreach of the Research is as important as the usual scientific dissemination. This goes beyond the scientific dissemination, that regards the theoretical and experimental results on specialistic journals and congresses, and it is often far from the public involvement. Knowledge must be shared not only in the restricted scientific community, bringing this information to the interested citizenship and not specialists. Therefore, the Department of Geosciences promotes the sharing of the scientific knowledge to a broader audience through divulgation and dissemination activities. We are aware that public visibility and reputation nowadays is based not only on our research and teaching ability, but also on communication to the public. In this respect, TV coverage, radio broadcasts, printed and online documents, video and digital contents (as interviews and documentaries) on social media are exceptionally efficient. For these reasons, the Department of Geosciences has considerably increased in the last years its commitment in social media with new social accounts in the most used platforms available. We promote public events, exhibitions, and educational activities, as well as the distribution of publications specifically addressed to a generic audience.

Frames from some of the Department of Geosciences 2023 dissemination videos.

Specifically, our researchers were hosted in many radio/TV interviews to explain their research topics, ranging from national news broadcasts to local radio stations. Dozens of events with schools and educational institutions took place. In total, more than 30 events aimed at promoting and presenting scientific results to the public community were organized. Among them, the Department of Geoscience participated actively to the week of the Research 2023 event. Webinars and online experiments for the wide publics were promoted, from lab experiences dedicated to generic audience to topic seminar of our activities. Barbara Paknazar is the head of the communication technology team, and is actively managing all social and YouTube profiles of the Departiment (https://www.youtube.com/@dipartimentodigeoscienze-u7871/featured)



A snapshot from the Department of Geosciences YouTube Channel.

Dr. Barbara Paknazar, Head of the Department team for communication and outreach.

New social accounts on the main used platforms as Instagram, Facebook, Twitter, YouTube were specifically developed to share with large audience the science we build during our everyday work. We have now hundreds of 'like' and followers of our Instagram profile, with thousands of visualizations of the videos there promoted. In this framework, the Department of Geosciences website was deeply re-designed, becoming our main external façade, especially during the forced social distance period imposed by the pandemic. News about events, publications, discoveries and activities were constantly updated, don't miss them! Keep serving science, keep serving our community, at our best.

Frames from some of the Department of Geosciences 2023 dissemination videos.

Coordination, data collection and integration, graphic design, editing and publication by

Telemaco Tesei

Luca Capraro

Stefano Castelli

Elisa Facciolo

Barbara Paknazar

Special thanks to those who actively contributed to the realization of this volume.