



**Proposal for the establishment of a Task Force of the  
International Lithosphere Program (ILP) for 2021-2025**

**LithoMar**  
**Assessing the relationships between lithospheric  
processes and seafloor topography at oceanic  
hotspots and divergent margins**

Proponents: Alessandra Savini<sup>1</sup>, Sebastian Krastel<sup>2</sup>, Aaron Micallef<sup>3,4</sup>, Paraskevi Nomikou<sup>5</sup>

<sup>1</sup> *University of Milan-Bicocca, Milan, Italy*

<sup>2</sup> *University of Kiel, Kiel, Germany*

<sup>3</sup> *GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany*

<sup>4</sup> *University of Malta, Malta*

<sup>5</sup> *University of Athens, Greece*

## **1. Introduction**

The proposed TF aims at improving the understanding of interactions between endogenous and underwater surface processes in determine seafloor topography at oceanic hotspots and divergent margins. The submarine realm constitutes more than the 70% of our planet and since few decades it represents a true frontier for research and resource exploitation. The investigation of the form, processes and evolution of submarine landscapes recently gained strong basic and applied value, and it is becoming a priority for many academic and research institutions, government authorities and industries globally. The seafloor is a vast reservoir of renewable and non-renewable resources, which include hydrocarbons, freshwater, aggregates, deep-sea minerals, blue energy and marine ecosystems and fisheries among others. Industries that exploit these resources are increasingly moving offshore, and on less accessible and known regions as the shallow and more accessible resources become depleted (Micallef et al., 2018a). In addition, the seabed and the sub-seafloor represent an important archive of global change (e.g. climate, ocean circulation, sea level). Last but not least, researchers dealing with geo-hazards at offshore infrastructures and coastal communities can recognize critical sources of hazards by studying the submerged landforms, such as those related to active faults by the new approaches of submarine paleoseismology, or those related to submarine volcanoes and landslide-prone slopes (e.g. Nomikou et al. 2016, Karstens et al. 2019, Watt et al. 2019).

LithoMar proposes an innovative approach to investigate relationships between lithospheric processes and submarine topography by promoting networking among several research groups with diverse expertise, contributing to the development of multidisciplinary knowledge on such complex subject. Moreover, linking offshore and onshore geology and tectonics is increasingly

becoming relevant in applied exploration, thanks to the innovative capability of acquiring geo-environmental data in marine setting at almost the same resolution of the on-shore setting (e.g. Gross et al., 2016). This represents also one of the most important aspects to be investigated by the present TF.

More in general, the activities promoted by of our TF will aim at improving the understanding of relationships and interactions between drivers of seafloor geomorphic changes at different temporal and spatial scale (see Fig. 1 for details), which can contribute to:

- assessing the impact of marine geohazards and establishing measures to mitigate associated impacts,
- operating a sustainable management of offshore resources,
- providing insights on the effect of Pleistocene and Holocene climate changes at oceanic hotspots and divergent margins.

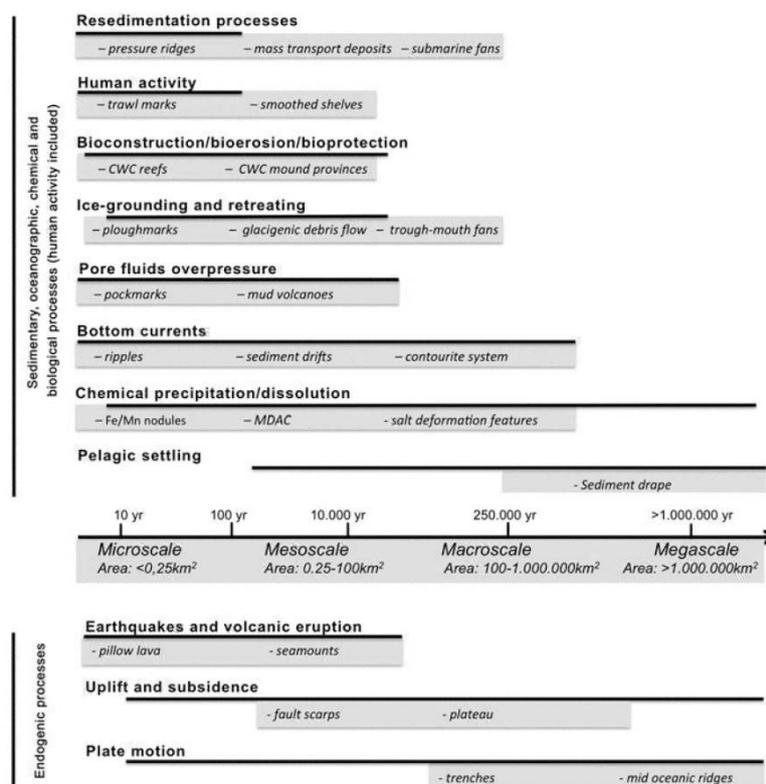


Fig. 1. List of the main drivers of seafloor geomorphic changes in submarine environments (see also Camerlenghi, 2018) and examples of resulting landforms at different spatial and temporal scales. The black line associated to each process refers to the temporal scale (see the black arrow for reference values), indicating the process lifespan required to create representative landforms. The grey boxes include an example of representative landforms for each spatial scale (see the grey box under the black arrow for reference values) (CWC = Cold-Water Corals; MDAC = Methane Derived Authigenic Carbonates). (from Micallef et al., 2018b).

## 2. Objectives

LithoMar will investigate to what extent endogenic processes (tectonics, volcanism, and fluid flow circulation) at submarine divergent margins and oceanic hotspots affect and interact with exogenic processes, with a focus on along-slope (driven by gravity) and down-slope (driven by density) deep-sea sedimentary processes (see Fig. 2 for details).

Tectonic activity and topographic evolution on diverging plates and oceanic hotspots are strongly linked across multiple spatio-temporal scales (i.e. from single earthquakes/fault

movements to plate deformation, or from single volcanic eruption to creation of submarine volcanic chains). Nonetheless, the imprint of deep processes in the resulting landforms and even on patterns of deformation with attendant hazards, has been mostly recognised and documented only over large spatio-temporal scales, and a comprehensive understanding regarding to what extent even spatially smaller and temporally shorter endogenous processes affect the submarine landforms is still missing. In addition, still there's a consistent gap in clarifying processes in terms of magnitude and frequency in their occurrences, which is of great relevance especially for geohazard assessment.

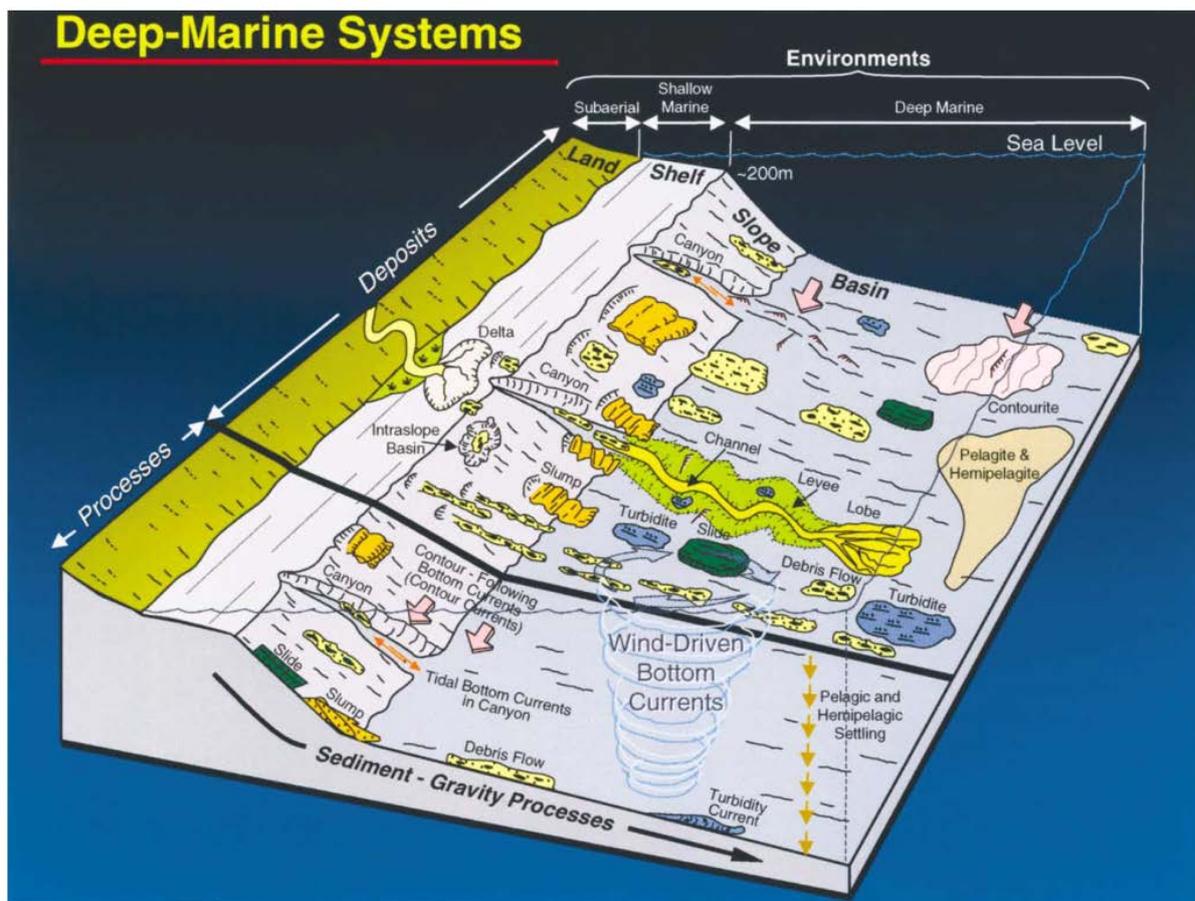


Fig. 2. Schematic diagram showing slope and basinal deep-marine sedimentary environments occurring at water depths deeper than 200 m (beyond the shelf-slope break). In general, shallow-marine (shelf) environments are characterized by tides and waves, whereas deep-marine (canyon, slope, and basin) environments are characterized by mass flows (i.e. slides, slumps, grain flows, and debris flows), various bottom currents (among which along-slope movement of contour-following bottom currents and circular motion of wind-driven bottom currents), and pelagic/hemipelagic deposition. From Shanmugam (2003).

Since the most part of the submarine environment has been relatively inaccessible to direct sampling and known mostly from 'remote' geophysical methods, few areas have been properly mapped and sampled, especially when they fall far from a mainland or out of the EEZ (Exclusive Economic Zone), as in the case of oceanic spreading centers. In addition, investigations on such areas have been often performed by different research groups, whose expertise grew focusing on a defined geological region and/or single geological topic (e.g. tectonics and geodynamics at specific spreading centers, deep-sea sedimentary processes, benthic habitat mapping, etc), with few exchange of information or active collaboration among the different regional experts. Our proposal aims at fostering interdisciplinary studies,

connecting experience researchers and younger scientists working on the proposed topics, addressing the problems exposed above.

## **2.1 Key topics to be addressed by the here proposed TF**

The project is structured in five different Work-Packages (WP), according to key questions to be addressed, that are considered relevant for ILP goals (Fig. 3):

- **WP1:** What is the topographic expression of volcanic and tectonic activity on divergent margins and oceanic hotspots over a wider range of spatio-temporal scales?

WP1 will be led by an expert in both tectonics and volcanology (A. Tibaldi) and will prepare a systematic database representing different settings at divergent margins as a response of long-term geomorphic processes. The database will be constructed by focused workshops, collaborations, and joint international projects.

- **WP2:** What are the measurable effects of tectonic activity in controlling deep-sea sedimentary processes and their topographic signature on divergent margins and oceanic hotspots during late Quaternary?

WP2 will be led by an expert in submarine geomorphology and deep-sea sedimentary processes (A. Micallef) and will focus on modelling magnitude and frequency of down-slope and along-slope deep-sea sedimentary processes, in relation to different tectonic settings at divergent margins and the measurable control of endogenic processes on sediment shear strength and accommodation space.

- **WP3:** What are the measurable effects of tectonic activity in affecting fluid circulation through the rocks and sediment in the subseafloor and which are their effect in promoting gas release at the seabed and into the atmosphere?

WP3 will be led by an expert in volcano-tectonic investigated at oceanic hotspots and seabed fluid flows (P. Nomikou), and will focus on modelling magnitude and frequency of fluid emission at the seabed and how they are affected by tectonic settings.

- **WP4:** How have volcanic and tectonic processes affected distribution of deep marine ecosystem and their extent?

WP4 will be led by an expert in seafloor and habitat mapping (A. Savini) and will focus on classifying and modelling distribution of deep-sea habitats according to late-Quaternary evolution at divergent margins resulting from long-term and short-term geomorphic processes.

- **WP5:** Which are the key measurable aspects of submarine landforms that contribute in deciphering the effect of endogenic processes and climatic forcing in modulating magnitude and frequency of deep-sea sedimentary processes at divergent margins and oceanic hotspots?

WP5 will be led by an expert in methods for deep-sea mapping and surveying (S. Krastel) and will focus on setting up the best practice to investigate deep-sea processes at multiple spatial scales, to better link the effect of endogenic processes on deep-sea sedimentary processes, at multiple spatial and temporal scales.

Although the connection between the discussed key questions is indisputable, their complexity makes very difficult to address them jointly, unless by favouring the dialogue between various scientists with diverse skills and creating a multidisciplinary network, as here proposed. We will spend our efforts to improve future investigations by linking multiple research approaches and technologies. We will organize international teams of scientists that will work in collaboration on structural geology and deep-sea sedimentary processes, laboratory and numerical studies, combined with stratigraphic, geochemical, geophysical and geochronological methods, to more precisely understand the complex interplay between geomorphic processes in the submarine realm, and in turn decipher their frequency and magnitude. Each WP is thus associated with a team of independent but integrated researchers including geologists, geomorphologists and geophysicists (see attached list – table 1), and covering both land and marine environments. With the aim of developing a multidisciplinary

knowledge on the proposed complex topics (Fig. 3), the establishment of the proposed network (among several research groups with diverse expertise) will be based on:

- the organization of project meetings, scientific events (contributing outreach and development of innovative teaching) and session proposal to international conferences,
- Supporting the participation of members of our TF to oceanographic/field campaigns.
- the identification of on-shore to off-shore field campaigns in key regions to answering the most important questions currently associated with lithosphere evolution and its effect on submarine geomorphic processes.
- the planning, preparation and submission of national and international projects.

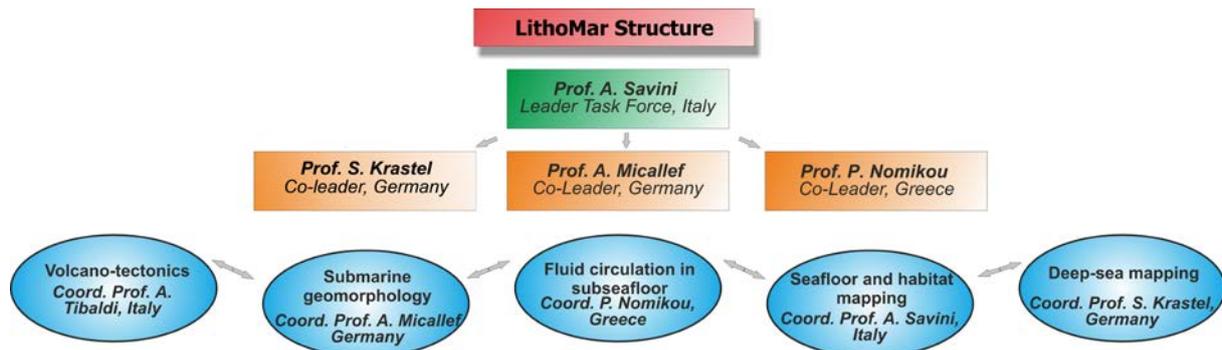


Fig. 3. Project structure

## 2.2 Relation to main goals and themes of ILP

Processes such as tectonism and volcanism are all themes classically developed under the umbrella of ILP. Key sites will be selected from most of the continents, representing all the possible geodynamic settings at divergent margins, as well as at hotspots. Hence, we believe that the objectives here proposed address practical problems that involve two of the four main program themes of the ILP, notably: *Oceanic Lithosphere*, but also *Geoscience of Global Change*. Present-day knowledge of forms and processes of spreading centres still has important gaps in knowledge, although a more comprehensive understanding is of relevance not only for our understanding of global tectonics, but also for understanding:

- Geohazard at spreading centres as a key topic to link deep and surface processes
- Resources at spreading centres (biological and geological and their sustainability in relation to global environmental changes)
- Relation with climate changes

The expected benefits of the project are mostly scientific as the project addresses a basic research aspect, but we envisage also significant societal benefits as the results obtained will be applied to improve our ability to forecast marine geohazard. In addition, several outreach activities (section 4) will give people a chance to experience the fascinating underwater world by Virtual Reality (VR) and be aware about major threats affecting the sustainable management of the richness of marine biological and geological resources, deeply threatened by anthropogenic activities.

## 3. Cooperation

All co-leaders are members of prestigious national and international Committees and scientific organizations (EGU, AGU, IAG, IGS), and are involved in several research projects dealing with the proposed research topics, also within the framework of EU funding (ERC, Horizon 2020, Marine Strategy). A. Micallef and S. Krastel are also respectively chair and co-chair of

the international working group on Submarine Geomorphology (promoted by IAG) where scientists from different disciplines are encouraged to interact and employ state-of-the-art seafloor exploration instruments and analytical techniques (e.g. high resolution bathymetry, side scan sonar, seismic reflection profiling, ROV, AUV, seabed sampling, seafloor classification, geomorphometry) to better understand the most extensive geomorphic system on our planet. A. Tibaldi has a long experience of collaboration within ILP.

Session proposals at international conferences (i.e.: EGU/AGU/IAG), thematic workshops and summer schools on research methods in submarine environments (aimed at better integrating deep and surface processes on divergent margin and oceanic hotspots) and short-term scientific missions among the different participants, will be scheduled in order to ensure cooperation. An intense use of modern dialogue techniques, such as videoconferencing, will allow a continuous harmonization among the four coordinators and with all participants. Each participant must know the contribute to the various research themes done by the others and the new initiatives. This will allow also to recognize possible missing parts in the whole research, in order to reorient it and to involve further specific needed skills. Input data to develop the research in this project will come from published data and joint research activities carried out within the framework of common project and collaborations, fostering the submission of new proposals.

#### **4. Outreach**

All co-leaders were, and still are, deeply involved in a number of outreach activities, from participation at public events with exhibitions and talks (e.g. kids university, meetmetonight - <http://www.meetmetonight.it/> among others), interviews for local newspapers and production/participation in documentary films. The preparation of a scientific documentary for the international FOCUS television channel has already been planned for June 2020 and will be conducted by A. Tibaldi. In case this activity would be considered important for ILP, we will be glad to include it under the ILP “flag”. This documentary will be devoted to popularize the processes that occur at a oceanic divergent margin, and will be filmed at various sites along the Iceland emerged ridge. Some of the proponents of the present TF have already been contacted in order to participate to this documentary. The team is also active in experiencing 3D optical reconstruction of the submarine environment, applying Structure from Motion (SfM) to underwater images (collected also by advanced marine robotics). 3D reconstructions have been then used to carry out pilot studies and to develop software for Virtual Reality (VR), in order to provide innovative tool for teaching and outreach actions, providing virtual underwater experiences for the culture and tourism industries. One of the aims of the team of A. Tibaldi is also to improve VR software in order to allow researchers, students and teachers to collaborate within the same real-world-based virtual environment as the team was at the same time in the same area, either on land or underwater. This improvement will also enable to connect the users via university intranet and internet. VR applications have also been presented to the International High School of Wien, in collaboration with the EGU outreach committee, and contributed to three international schools focused on geohazards, where VR was used for integrating more traditional teaching strategies. Future analogue activities are planned by the team.

#### **5. Key partners within this planned TF**

We propose a five-years Task Force project, during which the five WP leaders will foster collaboration and exchange of ideas and results from their research activities among all participants. As any other ILP project, the present one will promote networking tools, emphasising the celebration of a series of thematic workshops and/or session proposals to international conferences, training schools addressed to young researchers, short-term scientific missions, and dissemination activities. All WP leaders are deeply involved as PI or co-PI in a

number of research projects, this allowed set up a network of International, multidisciplinary, balance senior and early career scientists, as shown in table 1.

**Table 1**

<b>Participant</b>	<b>Institution</b>	<b>Country</b>	<b>Group of work</b>
Alessandro Tibaldi Andres Folguera B. Van Wyk de Vries Marc Sosson Páll Einarsson Ásta Rut Hjartardóttir Fabio Bonali Federico A. Pasquarè Valerio Acocella Giuseppina Lavecchia Andrey Koryenkov Joel Ruch Federica Lanza Serdar Ozalaybey Bill Rose Greg Waite Agust Gudmundsson	University of Milan Bicocca Universidad de Buenos Aires Univ. de Auvergne-Blaise Pascal, Clermont Ferrand Géoazur Université Haskoli Islands University Haskoli Islands University University of Milan Bicocca University of Insubria Università di Roma Tre, Roma University of Chieti-Pescara Institute of Geology of Moscow University of Geneve ETH, Zurich TUBITAK Marmara Research Centre Michigan Technological University Michigan Technological University Royal Holloway University of London	Italy Argentina France France Iceland Iceland Italy Italy Italy Italy Russia Switzerland Switzerland Turkey USA USA UK	<b>WP1</b>
Aaron Micallef Angelo Camerlenghi Michele Rebesco Domenico Ridente Roger Moore David Amblas Jen Karstens, Morelia Urlaub Lorena Moscardelli Joshu Mountjoy	University of Malta OGS OGS University of La Sapienza University of sussex University of Barcelona GEOMAR GEOMAR Statoil Res. and Technology NIWA	Malta Italy Italy Italy UK Spain Germany Germany USA New Zeland	<b>WP2</b>
Peraskevi Nomikou Danai Lampridou Neil Mitchell Christian Berndt Daniele Casalbore Giuseppe Etiopie Giuliana Panieri Stephanie Dupré	University of Athens University of Athens University of Manchester GEOMAR University of La Sapienza INGV CAGE-UiT Ifremer	Greece Greece UK Germany Italy Italy Norway France	<b>WP3</b>
Alessandra Savini Valentina Alice Bracchi Marco Taviani Verle Huvenne Geoffroy Lamarche Karine Olu Vincent Lecours	University of Milano-Bicocca University of Milano-Bicocca CNR-ISMAR NOC NIWA Ifremer University of Florida	Italy Italy Italy UK New Zeland France USA	<b>WP4</b>
Sebastian Krastel Felix Gross Jacob Geersen Fabio Marchese Aggeliki Georgeopoulou Deniz Cukur	University of Kiel University of Kiel GEOMAR University of Milano-bicocca University of Aberdeen Korea Institute of Geoscience and mineral resources	Germany Germany Germany Italy Ireland South Korea	<b>WP5</b>

## 6. References

- Camerlenghi A., 2018. Drivers of Seafloor Geomorphic Changes. In “Micallef A., Krastel S. and Savini A. (eds.) Submarine Geomorphology”, Springer, 135-159.
- Gross, F., Krastel, S., Geersen, J., Behrmann, J.H., Ridente, D., Chiocci, F.L., Bialas, J., Papenberg, C., Cukur, D., Urlaub, M., Micallef, A. (2016). The limits of seaward spreading and slope instability at the continental margin offshore Mt Etna, imaged by high-resolution 2D seismic data. *Tectonophysics*, 667, 63-76 doi: 10.1016/j.tecto.2015.11.011
- Karstens, J., Berndt, C., Urlaub, M., Watt, S.F.L., Micallef, A., Ray, M., Klaucke, I., Muff, S., Klaeschen, D., Kuhn, M., Roth, T., Bottner, C., Schramm, B., Eldger, J., Brune, S., 2019. From gradual spreading to catastrophic collapse - Reconstruction of the 1888 Ritter Island volcanic sector collapse from high-resolution 3D seismic data. *Earth and Planetary Science Letters*, 517, 1-13.
- Nomikou P., Druitt T. H., Hübscher C., Mather T. A., Paulatto M., Kalnins L. M., Kelfoun K., Papanikolaou D., Bejelou K., Lampridou D., Pyle D. M., Carey S., Watts A. B., Weiß B. & Parks M. M., 2016. Post-eruptive flooding of Santorini caldera and implications for tsunami generation. *Nature Communications* | 7:13332 | DOI: 10.1038/ncomms13332
- Micallef A., Krastel S. and Savini A., 2018a. *Submarine Geomorphology*, Springer.
- Micallef A., Krastel S. and Savini A., 2018b. Introduction. In “Micallef A., Krastel S. and Savini A. (eds.) *Submarine Geomorphology*”, Springer. 1-9.
- Shanmugam, G. 2003. Deep-marine tidal bottom currents and their reworked sands in modern and ancient submarine canyons. *Marine and Petroleum Geology*, 20, 471-491.
- Watt, S.F.L., Kerstens, J., Micallef, A., Berndt, C., Urlaub, M., Ray, M., Desai, A., Sammartini, M., Klaucke, I., Bottner, C., Day, S., Downes, H., Kuhn, M., Elger, J., 2019. From catastrophic collapse to multi-phase deposition: flow transformation, seafloor interaction and triggered eruption following a volcanic-island landslide. *Earth and Planetary Science Letters*, 517, 135-147.

# Curriculum vitae chair and co-chair(s)

## Curriculum Vitae Dr. Alessandra Savini

Current Positions: Assistant Professor in Geomorphology and Physical Geography, University of Milano-Bicocca, Milan, Italy  
Address (work): Dept. of Earth and Environmental Sciences, University of Milano-Bicocca, Piazza della Scienza 4, 20126, milano, Italy, Tel: +39-02-64482079, Fax: +39-02-64482073, Email: [alessandra.savini@unimib.it](mailto:alessandra.savini@unimib.it)

### *Education & professional experience*

Since 01.12.2008: **Assistant Professor** in Physical Geography and Geomorphology, Dept. of Earth and Environmental Sciences, School of Sciences, University of Milano-Bicocca, Milan, Italy  
2006 – 2008: **Researcher** temporary position - CoNISMa (national interuniversity consortium for marine sciences) – Local Research Unit of Milano-Bicocca University  
2006: Principle **Marine Geophysicist/Geologist** for RESON MEDITERRANEAN (BO – Italy)  
2004 – 2006: **Post-doctoral fellowship** - CoNISMa (national interuniversity consortium for marine sciences) – Local Research Unit of Milano-Bicocca University.  
2004: **Ph.D. Thesis** in Geological Sciences and Geotechnologies (University of Milano-Bicocca, Italy). Title: “Marine Geophysical data analysis and management in GIS applications”.  
2001: **Master** in Applied Geophysics (Institute of geophysics and marine environment, La Spezia, Italy).  
1999: **Graduate research assistant**. CoNISMa (national interuniversity consortium for marine sciences) – Local Research Unit of Milano-Bicocca University.  
1999: **Master of Science in Natural Sciences**, Faculty of Mathematical Physical and Natural Sciences, University of Milan, Italy.

### *Responsibilities*

Since 01.10.2012: Member of the Scientific Committee of MaRHE (Marine Research and High Education) center ([www.marhe.unimib.it](http://www.marhe.unimib.it)), Milano-Bicocca outpost at Magoodhoo island, Faafu atoll, Republic of Maldives.  
Since 2013: Member of the Submarine Geomorphology working Group (IAG – International Association of Geomorphologists)  
2017: Consultant – Ministry of Agriculture, Rural Development and Environment, Department of Fishery and Marine Resources, Republic of Cyprus. Preparation of the Scope of the work (SoW) for a survey of the benthic biodiversity of Eratosthenes Seamount in the EEZ of the Republic of Cyprus.  
2012-2016: Team member of the ESF Research Networking Program – COCARDE – COld-water CARbonate Reservoir System in Deep Environment. <http://www.cocarde.eu>.  
2008-2012: Member of the Steering Committees of the VII<sup>o</sup> EU FP – CORALFISH project, and co-PI.  
2007-2012: Member of the Technical Committee of MAGIC project (Marine Geohazard along the Italian Coasts), funded by Civil Protection, Italy.  
More than 40 oceanographic research cruises and expeditions focused on submarine geomorphology, with emphasis on deep-sea habitats (marine bioconstruction, from tropical to cold-water corals), exploration of cold-seeps systems, landslides and slope instability. Chief scientist in 19.  
Participation in numerous National and International research projects as coordinator, WP leader or task leader. Supervision of more than 20 bachelor and master degree thesis in Geological Sciences and Geotechnology, 2 PhD positions and 4 Postdocs. Reviews for scientific journals and projects and guest editor for special issues. Convener and presenter at International Meetings. Organization of doctorate and training schools focused on seafloor mapping technologies. Public outreach activities (exhibitions, talks, etc.), including interviews in Italian newspapers and TV reports. Consultant for private and public companies.

*5 recent key publications by the proponent relating to the proposed TF/CC*

- Bonali, F., Tibaldi, A., Marchese, F., Fallati, L., Russo, E., Corselli, C., **Savini A.** (2019). UAV-based surveying in volcano-tectonics: An example from the Iceland rift. *Journal of Structural Geology*, 121, 46-64.
- Micallef A; Krastel S; **Savini A** (eds.) 2018. *Submarine Geomorphology*. Springer
- Savini A.**, Pinson S., Bistacchi A. and C.W. Holland (2018). Imaging shallow gas migration pathways in a mud-volcano province using an autonomous underwater vehicle (Malta Plateau, Mediterranean Sea). *Near Surface Geophysics*, doi: 10.1002/nsg.12017
- Bargain A, Marchese F., **Savini A.**, Taviani M., Fabri MC (2017). Santa Maria di Leuca province (Mediterranean Sea): Identification of suitable mounds for cold-water coral settlement using geomorphometric proxies and maxent methods. *Frontiers in Marine Science*, vol. 4, 338, ISSN: 2296-7745, doi: 10.3389/fmars.2017.00338.
- Savini A.**, Marchese F., Verdicchio G. and Vertino A. (2016) Submarine slide topography and the distribution of vulnerable marine ecosystems: a case study in the Ionian Sea (eastern Mediterranean). In: Lamarche G, et al. (eds) *Submarine mass movements and their consequences*, *Advances in Natural and Technological Hazards Research*, Springer, Dordrecht, 41, pp 163–170.

# Curriculum Vitae Prof. Dr. Sebastian Krastel

Current Positions: Professor for Marine Geophysics and Hydroacoustics

**Address (work):** Institut für Geowissenschaften  
Christian-Albrechts-Universität zu Kiel, Institut für Geowissenschaften  
Otto-Hahn-Platz 1, 24118 Kiel, Germany  
Tel: +49-431-880-3914, Fax: +49-431-880-4432  
Email: [skrastel@geophysik.uni-kiel.de](mailto:skrastel@geophysik.uni-kiel.de)

## *Education & professional experience*

Since 01.10.2012 Professor for 'Marine Geophysics and Hydroacoustics'  
Kiel University  
03.2008-30.09.2012 Professor for 'Submarine Hazards at Continental Margins'  
GEOMAR, Kiel University  
2007-2008 'Senior Scientist' at the 'Marine Technology/ Environmental Research'  
Group of the Department of Geosciences, Bremen Uni.  
2001-2006 'Scientist' at the 'Marine Technology/ Environmental Research' Group  
of the Department of Geosciences, Bremen Uni.  
1999 – 2000 Post-Doc at GEOMAR Research Center, Kiel, Germany.  
Project: 'Volcanic and geodynamic evolution of the Canary  
Archipelago and adjacent seamounts'.  
Dec. 1999 Ph.D. in Earth Sciences.  
Title of thesis: 'Growth processes and destructive events during the  
evolution of volcanic islands: a case study from the Canary Islands'.  
1995-1999 Ph.D. student at the graduate school 'Dynamics of Global Cycles',  
GEOMAR Research Center, Kiel, Germany.  
Jun. 1995 MSc (Diplom Geophysiker).  
1988-1995 Study of Geophysics at Christian-Albrechts-Universität, Kiel, Germany.

## *Responsibilities*

Managing Director Institute of Geosciences, Kiel University  
More than 50 research cruises and expeditions on lakes (several as chief  
scientists)  
PI of two scientific drilling projects  
Coordinator of the DFG Priority Program ICDP SPP 1006  
Member of the IODP Scientific Technology Panel and Site  
characterization panel  
Several research stays at foreign universities  
Teaching since 2001  
Reviews for scientific journals and projects  
Convener and presenter at International Meetings  
Public outreach activities (exhibitions, talks, kids university ect.)

*5 recent key publications by the proponent relating to the proposed TF/CC*

- Schulten, I., Mosher, D.C., Piper, D.J., **Krastel, S.** (2019) A massive slump on the St. Pierre Slope, a new perspective on the 1929 Grand Banks submarine landslide. *Journal of Geophysical research*, 124, 7538-7561, <https://doi.org/10.1029/2018JB017066>
- Urlaub, M., Petersen, F., Gross, F., Bonforte, A., Puglisi, G., Guglielmino, F., **Krastel, S.**, Lange, D., and Kopp, H. (2018) Gravitational collapse of Mount Etna's southeastern flank, *Science Advances*, 4 (10), eaat9700, DOI: 10.1126/sciadv.aat970
- Böttner, C., Gross, F., Geersen, J., Crutchley, G., Mountjoy, J., **Krastel, S.** (2018) Marine forearc extension in the Hikurangi margin: New insights from high-resolution 3D seismic data, *Tectonics*, 37, 1472-1491, <https://doi.org/10.1029/2017TC004906>
- Krastel, S.**, Li, W., Urlaub, M., Georgiopoulou, A., Wynn, R.B., Schwenk, T., Stevenson, C., Feldens, P. (2018) Mass wasting along the NW-African continental margin. in: *Subaqueous Mass Movements* (eds: Lintern, D.G. et al). Geological Society, London, Special Publications, 477, <https://doi.org/10.1144/SP477.36>
- Gross, F., **Krastel, S.**, Geersen, J., Behrmann, J.H., Ridente, D., Chiocci, F.L., Bialas, J., Papenberg, C., Cukur, D., Urlaub, M., Micallef, A. (2016) The limits of seaward spreading and slope instability at the continental margin offshore Mt Etna, imaged by high-resolution 2D seismic data. *Tectonophysics*, 667, 63-76 doi: 10.1016/j.tecto.2015.11.011

## Curriculum Vitae Prof. Aaron Micallef

Current Positions: Associate Professor, **Department of Geosciences, University of Malta**

**Address (work):** Marine Geodynamics  
Room 8C-205 GEOMAR Helmholtz Centre for Ocean Research  
Kiel Wischhofstrasse 1-3, 24148 Kiel, Germany

### *Education & professional experience*

Apr 2019 – present: Senior scientist, GEOMAR  
Mar 2015 – present: Associate professor, Department of Geosciences, University of Malta, Malta.  
Sep 2014 – Mar 2015: Senior lecturer, Department of Physics, University of Malta, Malta.  
Sep 2013 – Sep 2018: Marie Curie fellow, University of Malta, Malta  
Oct 2010 – Oct 2012: Marie Curie fellow, University of Barcelona, Spain.  
Sep 2009 – Sep 2014: Lecturer, Department of Physics, University of Malta, Malta.  
Oct 2004 – Mar 2008: Ph.D. in Marine Geology and Geophysics, National Oceanography Centre, University of Southampton, United Kingdom.  
Oct 2002 – Sep 2003: M.Sc. in Environmental Geomorphology, School of Geography and the Environment, University of Oxford, United Kingdom.  
Oct 1998 – Jul 2002: B.A. (Hons.) Geography, Department of Geography, University of Malta, Malta.

### *Responsibilities*

2015 – present: Chair of International Association of Geomorphologists Working Group on Submarine Geomorphology  
2015 – present: Member of scientific committee of INCISE ((International Network for Submarine Canyon Investigation and Scientific Exchange) and S4SLIDE  
2015 – present National representative on MIGRATE, MEDSALT COST Actions  
2015 – present Member, European Geosciences Union, International Association of Sedimentologists, Marie Curie Alumni Association  
PI or co-PI of the following projects:  
MARCAN - Topographically-driven meteoric groundwater: An important geomorphic agent (Horizon 2020 European Research Council) - 1.8 million Euros  
SMART - Sustainable management of offshore groundwater resources (Helmholtz European Partnering) - 1.5 million Euros (can be extended to 2.5 million Euros in 2022)  
HYFREW - Hydrogeophysical studies for the characterisation and monitoring of freshwater in coastal area: Laboratory and test site applications (CNR-University of Malta) - 20,000 Euros  
TrawledSeas - Bottom trawling as a driver of deep seascape transformation (Horizon 2020 Marie Curie fellowship) - 150,000 Euros  
SCARP - Canyon and landslide processes of non-tropical carbonate escarpments (FP7 Marie Curie fellowship) - 100,000 Euros  
CAESAR - Carbonate vs. siliciclastic margins: A multi-scale comparison of submarine canyon and landslide morphologies and processes (Fulbright Visiting Scholarship) - 10,000 Euros  
CAGE - Submarine canyons: Applying geomorphometry to understand their evolution (FP7 Marie Curie fellowship) - 150,000 Euros  
EMODnet Bathymetry (European Maritime and Fisheries Fund) - 10 million Euros  
Supervision of 3 post-doctoral research associates, 5 PhD students and 3 MSc Students.  
Teaching since 2009  
Reviewer for scientific journals and projects, convener and presenter at international Meetings and public outreach activities.

*5 recent key publications by the proponent relating to the proposed TF/CC*

- Watt, S.F.L., Kerstens, J., **Micallef, A.**, Berndt, C., Urlaub, M., Ray, M., Desai, A., Sammartini, M., Klaucke, I., Bottner, C., Day, S., Downes, H., Kuhn, M., Elger, J., 2019. From catastrophic collapse to multi-phase deposition: flow transformation, seafloor interaction and triggered eruption following a volcanic-island landslide. *Earth and Planetary Science Letters*, 517, 135-147.
- Karstens, J., Berndt, C., Urlaub, M., Watt, S.F.L., **Micallef, A.**, Ray, M., Klaucke, I., Muff, S., Klaeschen, D., Kuhn, M., Roth, T., Bottner, C., Schramm, B., Eldger, J., Brune, S., 2019. From gradual spreading to catastrophic collapse - Reconstruction of the 1888 Ritter Island volcanic sector collapse from high-resolution 3D seismic data. *Earth and Planetary Science Letters*, 517, 1-13.
- **Micallef, A.**, Camerlenghi, A., Garcia-Castellanos, D., Cunarro Otero, D., Gutscher, M.-A., Barreca, G., Spatola, D. \*, Facchin, L., Geletti, R., Krastel, S., Gross, F., Urlaub, M., 2018. Evidence of the Zanclean megaflood in the eastern Mediterranean Basin. *Scientific Reports*, 8(1), 1078.
- Mountjoy, J.J., Howarth, J.D., Orpin, A.R., Barnes, P.M., Bowden, D.A., Rowden, A.A., Schimel, A.C.G., Holden, C., Horgan, H.J., Nodder, S.D., Patton, J.R., Lamarche, G., Gerstenberger, M., **Micallef, A.**, Pallentin, A., Kane, T., 2018. Earthquakes drive large-scale submarine canyon development and sediment supply to deep-ocean basins. *Science Advances*, 4(3).
- **Micallef, A.**, Mountjoy, J., Barnes, P.M., Canals, M., Lastras, G., 2014. Geomorphic response of submarine canyons to tectonic activity: Insights from the Cook Strait canyon system, New Zealand. *Geosphere*, 10(5), 905-929.

## Curriculum Vitae Dr. Paraskevi Nomikou

Current Positions: Assistant Professor in Geological Oceanography and Natural Geography, Faculty of Geology and Geoenvironment, UoA, Greek

Address (work): Faculty of Geology and Geoenvironment, University of Athens  
Panepistimioupoli Zografou, 15784, Athens, Greece  
Tel: +302107274865  
Email: [evinom@geol.uoa.gr](mailto:evinom@geol.uoa.gr)

### *Education & professional experience*

Since 01.10.2012 **Assistant Professor** in Geological Oceanography and Natural Geography, Faculty of Geology and Geoenvironment, UoA, Greek

12.2017 **Guest Investigator** in the Applied Ocean Physics and Engineering department, Woods Hole Oceanographic Institution (WHOI), USA

03.2013/4.2014 **Guest Investigator** in the Applied Ocean Physics and Engineering department, Woods Hole Oceanographic Institution (WHOI), USA

03.2011 **Adjunct Professor**, Department of Geosciences, University of Rhode Island (URI), USA

2002-2013 **Research Associate**, Assistant teaching of the laboratories of the Applied Geology, Tectonics, Geology of Greece, Structural Geology, Environmental Geology, Oceanography, UoA.

2000-2002 **Member of the administrative board of the General Secretariat for Civil Protection**, Ministry of Interior, Public Administration and Decentralization.

2004 **Ph.D. Thesis** in Marine Geodynamic & Geological Sciences, Faculty of Geology & Geoenvironment, National Kapodistrian University of Athens (UoA), Greece. Title: “Submarine Geodynamics between Kos & Nisyros volcano, Dodecanese, Greece”.

1999 – 2002 **Researcher** of the Institute of Oceanography, Hellenic Centre for Marine Research (HCMR).

1996 **Bachelor of Science in Geology**, Faculty of Geology, UoA.

### *Responsibilities*

Since 01.10.2012 Selected Scientific Expert in the CBD Expert workshop for ecologically or biologically significant marine areas (EBSAs), nominated by the Greek Ministry of Environment and Energy in response to CBD Notification 2017-086

More than 80 research cruises and expeditions focused on submarine volcanism, mud volcanoes, landslides, slope stability and the exploration of seafloor mineral deposits in Mediterranean Sea, Red Sea, Atlantic Ocean and Pacific Ocean

Dives with submersible “Thetis” of HCMR in all Greek submarine volcanoes

Co-PI of PROTEUS NSF project: Crustal magma plumbing of the Santorini volcanic System, 2015. PI: Prof. Emillie Hooft

Co-PI of Erasmus+ Key Action 2 Higher Education Strategic Partnership project: 3DTeLC (2017-2020). PI Malcolm Whitworth

PI of Coordinator of VirtualDIVER (2018-2021), GSRT call 2017: Development of an integrated interactive platform providing virtual underwater experiences for the culture and tourism industries

Several research stays at foreign universities

Reviews for scientific journals and projects

Convener and presenter at International Meetings

Public outreach activities, including more than 50 interviews in Hellenic newspapers and

Touristic guide books and the participation in documentary films such as:

“Santorin-Die Schone auf dem Pulverfass”, Mare TV, Germany, 2013,

[http://www.ndr.de/fernsehen/sendungen/mare\\_tv/media/maretv419.htm](http://www.ndr.de/fernsehen/sendungen/mare_tv/media/maretv419.htm)

1 “Atlantis Found” History Channel, 2015,

<http://www.history.com/shows/atlantis-found/about>

TRAVEL CHANNEL 2016 “Expedition Unknown”,

<https://www.youtube.com/watch?v=EJ0PPZfPdzs&t=115s>

ZDF documentary, “Die Wellenbrecher”, 2017

<https://www.zdf.de/dokumentation/terra-x/videos/ein-fall-fuer-lesch-und-steffens-wellenbrecher-100.html>

#### *5 recent key publications by the proponent relating to the proposed TF/CC*

- Parks M., Biggs J., England P., Mather T., **Nomikou P.**, et al., (2012): Evolution of Santorini Volcano dominated by episodic and rapid fluxes of melt from depth. Nature Geoscience. DOI: 10.1038/NGEO1562.
- Carey S., **Nomikou P.**, et al., (2013): CO<sub>2</sub> Degassing from Hydrothermal Vents at Kolumbo Submarine Volcano, Greece and the Accumulation of Acidic Crater Water. Geology. September 2013, Volume 41, Number 9, 1035-1038.
- Parks M., et al., (2013): Distinguishing contributions to diffuse CO<sub>2</sub> emissions in volcanic areas from magmatic degassing and thermal decarbonation using soil gas <sup>222</sup>Rn-δ<sup>13</sup>C systematic: application to Santorini volcano, Greece. Earth and Planetary Science Letters 377-378 (2013) 180-190.
- Camili R., **Nomikou P.**, et al., (2015): “The Kallisti Limnes, Carbon Dioxide-Accumulating Subsea Pools.” SCIENTIFIC REPORTS | 3:2421. doi:10.1038/srep02421.
- **Nomikou P.**, et al. (2016): Post-eruptive flooding of Santorini caldera and implications for tsunami generation. NATURE COMMUNICATIONS | 7:13332 | DOI: 10.1038/ncomms13332.