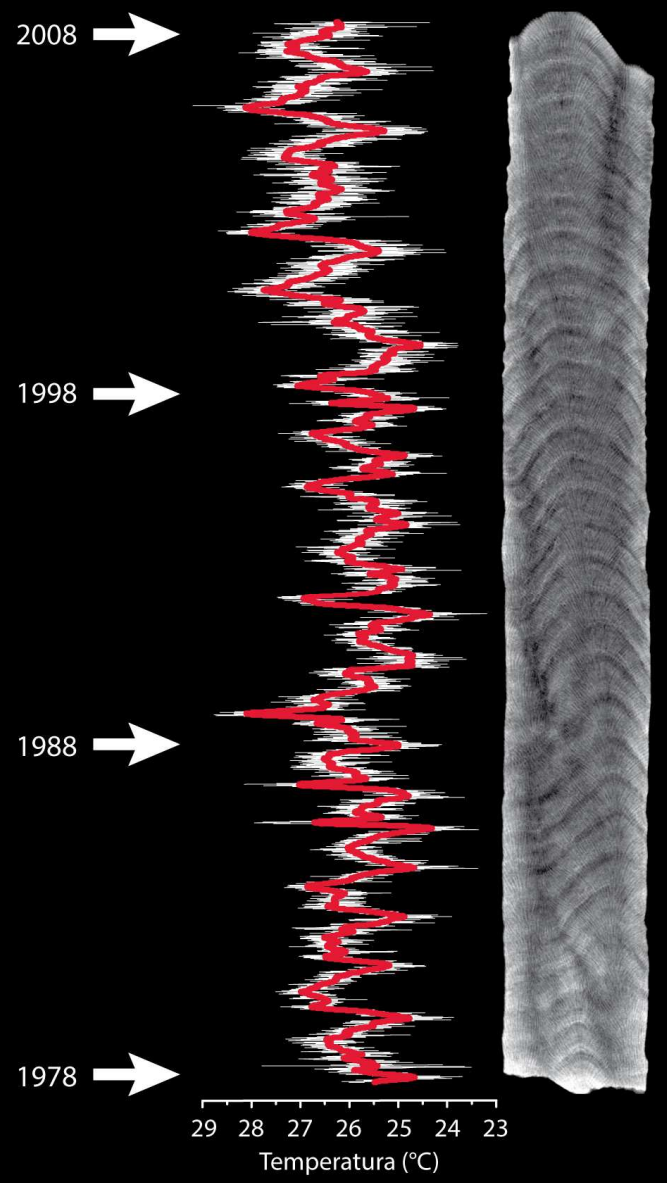
Dipartimento di Scienze Biologiche,
Geologiche e Ambientali
Università di Catania

Museo di
Paleontologia

Dottorato di Ricerca
Scienze della Terra
e dell'Ambiente



Corso di Paleoecologia
Prof.ssa Antonietta Rosso
Corso di Laurea in Scienze Geologiche

Seminario

Mercoledì 28 Aprile 2021
Ore 10.00

Coral geochemistry as a tool to reconstruct the climate variability in the past

ISP Istituto di Scienze Polari
Consiglio Nazionale delle Ricerche

Dott. Paolo Montagna
ISP-CNR (Bologna)

Coral geochemistry as a tool to reconstruct the climate variability in the past

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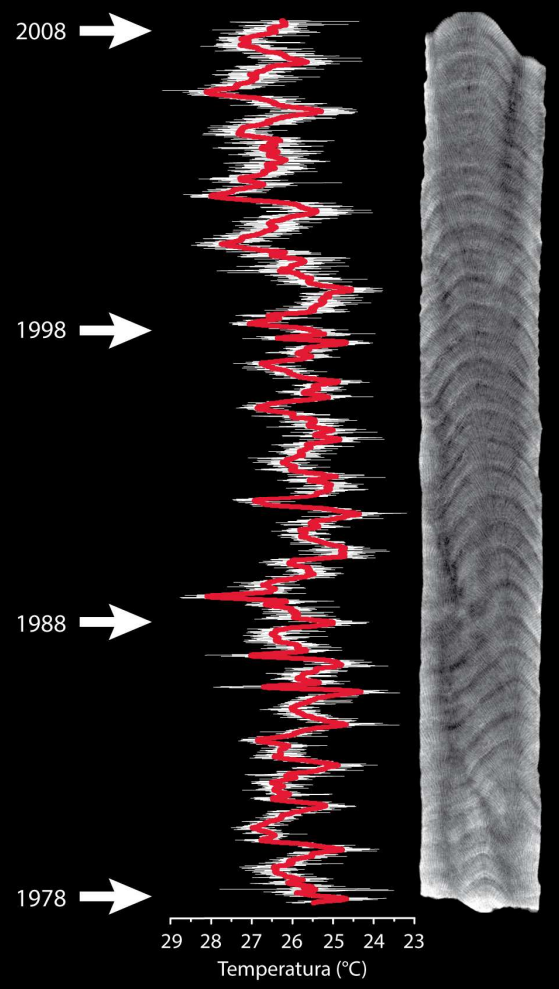
Earth's history has experienced a range of natural climate shifts that can be investigated to gain valuable information on the functioning and sensitivity of our climate system and provide context for the present and future climate change. However, geologic climate variables are rarely recorded directly (e.g. air bubbles in ice cores), and paleoclimatologists use a variety of natural archives and "proxies" to reconstruct climate variations in the past.

Scleractinian corals can provide multi-century, sub-annual resolution paleoceanographic records. They can be precisely dated by ^{230}Th/U technique and they systematically incorporate isotopic and chemical tracers that reflect the environmental conditions of the ambient seawater.

On the other hand, the chemical and isotopic signals encoded into coral skeletons can be used to investigate the biomineralization processes and model the coral calcification rate in the future. In particular, the boron isotopes extracted from the skeleton of zooxanthellate and azooxanthellate corals can effectively be used to quantify the internal pH and the response of calcification to ocean acidification and rising seawater temperature (McCulloch et al., 2012).

With the recent advances in analytical techniques, non-traditional stable and radiogenic isotopes can now be measured in relatively small coral portions and the results can be combined with established tracers in a unique multi-proxy approach.

I will present geochemical results from shallow- and deep-water corals from the Mediterranean Sea and the Southern Ocean. In particular, I will discuss the use of Li/Mg ratio and boron isotopes as reliable proxies for seawater temperature and pH as well as coupled U/Th and ^{14}C for water-mass ventilation, with examples based on long-lived specimens and coral fragments from sediment cores.



McCulloch M., Falter J., Trotter J., Montagna P. (2012). Coral resilience to ocean acidification and global warming through pH up-regulation. Nature Climate Change, 2, 623-627.

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Biosketch: Paolo Montagna is a senior researcher at the Institute of Polar Sciences (ISP-CNR) in Bologna with interests in the geochemistry of biogenic carbonates for palaeoclimate reconstructions and biomineralization studies. He obtained his PhD in Earth Sciences from the University of Padova (Italy) in collaboration with the Australian National University. He was awarded a three year post-doctoral Marie Curie International Outgoing Fellowship, for which he spent two years at Lamont-Doherty Earth Observatory at Columbia University and one year at the Laboratoire des Sciences du Climat et de l'Environnement in Gif-sur-Yvette. Paolo's research focuses on the development and application of geochemical proxies to address fundamental problems in paleoceanography and paleoclimatology. This includes the analysis of minor and trace elements, as well as stable ($^{11}B/^{10}B$) and radiogenic ($^{143}Nd/^{144}Nd$, $^{87}Sr/^{86}Sr$, $^{230}Th/U$) isotopes in shallow and deep-water coral skeletons. He has participated in 18 oceanographic missions (one as Chief-Scientist and one as Co-chief Scientist) to the Mediterranean Sea, Atlantic, Indian and Pacific Oceans, as well as the Ross Sea off Antarctica. He has also been involved in several SCUBA diving expeditions worldwide to collect corals for geochemical studies.