

1. Research activity (max 1.000 words)

The main research activities concern the sedimentology of carbonates with particular focus on the isotopic study of Carbon and Oxygen to perform paleoclimatic and paleoenvironmental reconstructions starting from the measurement of stratigraphic sections and observation of thin sections to understand facies associations, stratigraphic architectures, stacking patterns and depositional models.

The goal concerning the study of the global climatic events through chemostratigraphy is to understand the relationships that links the perturbations of the C cycle to the climate and the biosphere.

Research objectives

General objective

the aim is to identify the perturbations of the C-cycle, in the record of $\delta^{13}\text{C}$ in carbonate platform successions between the middle Eocene and the lower Oligocene, at the end of a greenhouse period and the establishment of an icehouse phase. The comparison between the Carbon isotopic record in carbonatic successions of the central Mediterranean and the global record allows to identify the influence of regional factors that can mask or amplify the global signal.

The long-term purpose of high level regards the study of variations in carbonate production and the resulting stratigraphic architecture that may or may not be associated with global climate events and related perturbations of the C cycle. The physical response of the carbonatic platforms to these events could lead to clarify the relationships that link the perturbations of the C cycle to the climate and the biosphere.

Specific objective

Identification of C-cycle perturbations during global climate events recorded between the middle Eocene and the first marked glaciation of Antarctica during the lower Oligocene in carbonatic platforms of the central Mediterranean.

Implications

Atmospheric pCO_2 at the Eocene-Oligocene transition is comparable to the current concentration (~400 ppm), but it does not appear that the Earth is heading towards an ice age, such as that during Oi-1 event caused the birth of the Antarctic polar ice cap, but rather to a growing global warming caused by the greenhouse effect. The results that will be achieved with the isotopic data obtained from the study of eocenian carbonates will allow to deduce if the mechanisms that regulate the triggering of these climate switches are controlled by orbital, tectonic, volcanic and / or anthropic processes (Zachos et al., 2001): The combustion of hydrocarbons involves the emission of large quantities of CO_2 into the atmosphere, whose growing concentration is considered one of the causes of climate change.

Work plan

The project includes field surveys and laboratory analysis. The field survey consists in the measurement of stratigraphic sections and processing of logs that describes the facies analysis and the position of the samples to be submitted to analysis of microfacies, biostratigraphic and isotopic. Several thin sections will be examined which will integrate field observations. Will be perform analysis of the isotopic ratios of O and C which will provide information on the climate and tropism of the sedimentation basin. On the thin sections will be carried out a quantitative analysis of microfacies (point counting) and a statistical elaboration (factor analysis, hierarchical cluster analysis), using the SSPS software, aimed to characterize the deposits and evaluating the carbonate production changes. Before the isotopic analysis Samples will be selected under a petrographic microscope, cathodoluminescence and SEM to verify that the skeletal fraction has retained its original structure. Sampling with micro-drill (0.5 mm Ø tungsten drill bits) will be performed. Analysis will be carried out to evaluate any diagenetic overprints on the samples to be analyzed isotopically, such as the measurement of Mg, Sr, Mn and Fe concentrations, with the ICP-AES spectrometer of the DST. The analysis of the isotopic composition will follow ($\delta^{13}\text{C}$, $\delta^{18}\text{O}$) with the mass spectrometer Finnigan Mat 252 (IGAG-CNR, Rome). Biostratigraphic analysis involves the study of macroforaminiferal associations, according to the scheme of Serra-Kiel et al. (1998), integrated with the biostratigraphy of nannofossils in collaboration with the micropaleontologists of the G. D'Annunzio University of Chieti. The carbonate platforms in question outcrops on the Majella Massif and the Lessini Mountains, while the pelagic succession outcrops in the northern Apennines. The Paleocene-Oligocene interval is represented in Majella by the Santo Spirito Fm., intermediate and distal portion of ramp. The stratigraphic structure of this formation was recently revised (Raffi et al. 2016, Cornacchia et al. 2018), providing stratigraphic constraints necessary for the correlation. On the Lessini Mountains a cenozoic platform outcrops whose geometric relationships are preserved, where biostratigraphic analyzes have already been performed (Jaramillo-Vogel et al., 2013), while chemiostratigraphic data are absent. The Contessa quarry offers a spectacular section of the Umbria-Marche pelagic succession where the isotopic signal will be investigated in the Scaglia Variegata and Cinerea Formations to be correlated with the curves referring to the platform (shallow-water) sections. An internship abroad is planned on the outcrops of the western Pyrenees, where the platform-basin relationships are preserved. Also in this case the stratigraphic constraints have been fixed, as well as the geometric relations and the carbonatic production changes (Baceta et al. 2005, Pomar et al. 2017) while isotopic data are absent. This collaboration would integrate data from the central Mediterranean to those of the Atlantic, to discriminate global events from regional ones.

2. Research products

a) Publications (ISI journals)

Tomassetti L., Petracchini L., Brandano M., Trippetta F., Tomassi A., 2018, "Modeling lateral facies heterogeneity of an upper Oligocene carbonate ramp (Salento, southern Italy)" *Marine and Petroleum Geology*, 96, 254-270.
doi.org/10.1016/j.marpetgeo.2018.06.004

b) Abstracts

Cornacchia I., Agostini S., Brandano M., Tomassi A., " Miocene Central Mediterranean oceanographic evolution. What do Sr and Nd isotopes tell us? " XIII Congresso GeoSed-Sezione di Geologia del Sedimentario della Societa Geologica Italiana, 16-20 Giugno 2017, Perugia.

N.B. I dottorandi del primo anno al punto 1 possono inserire il riassunto del progetto di ricerca (max 1.000 parole)