NEW CLUES ABOUT THE CONTINENTAL ORIGIN OF DEEP SUBMERGED RELIEF IN THE MEDITERRANEAN SEA: THE TERRESTRIAL *IN SITU*-PRODUCED COSMONUCLIDES SIGNATURE OF ROCK SURFACES AND SCREE DEPOSITS ALONG THE SARDINIAN CHANNEL SCARPS

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Abstract

The *in situ*-produced cosmonuclides are widely used for cosmic ray exposure dating of continental surfaces. Some recent works have investigated the ^{10}Be-^{26}Al system to assess the burial age of cave-deposited sediments. In the marine environment, the *in situ*-produced cosmonuclides can be also used as tracers of continental exposition before rapid and deep (>100m) submersion. The ^{10}Be-^{26}Al system may help to constrain the age of the submersion. Here, we have tested this method by measuring the ^{10}Be-^{26}Al signature of deeply submerged scarps in the Sardinia Channel regarded as fossil messinian erosion surfaces [1].

Keywords : Sardinia Channel, messinian environment, cosmogenic nuclides

Introduction

Many inactive canyons carved in cohesive rock series are found on the Mediterranean submarine scarps. Canyon formation is commonly ascribed to the repeated erosion of bedrock by turbidity currents along a single path, or by self-driven gravitational collapse. Many mediterranean scarps, however, have been exposed to atmospheric erosion during the messinian salinity crisis, and the canyons could be continental weathering features as well.

The messinian erosion surface can be used as a reference surface to discriminate pre-messinian and post-messinian evolution of the mediterranean relief. However, it is often difficult to date the scarp formation since sediments deposited onto the surfaces are periodically removed by sliding. We had to address this issue along the southern scarps of the Sardinian Channel which were explored with the Cyana submersible in 1994 and 1995.

In situ-produced cosmonuclides offer us the possibility do test, 1/ if the upper few meters of the present submarine surfaces have been previously exposed to cosmic rays, 2/ if this exposure took place during the messinian crisis.

Evolution of the Sardinian Channel structure and morphology from Tortonian to Present

The Sardinian Channel is a submerged rift located SE off Sardinia. Rifting and crust thinning during the early Miocene and then during Tortonian [2] led to the formation of this narrow channel. Tectonic activity dropped markedly and remained very low during the Pliocene and Quaternary. The channel was deeply flooded during the Pliocene owing both to the refilling of the Mediterranean sea after the messinian crisis and to a strong post-rifting subsidence.

Along the steepest slopes the pre-tortonian basement outcrops under below the Plio-Quaternary sedimentary cover. Five dives were devoted to the exploration of the scarps located south of the Cornaglia Terrace. The upper slopes (above -1500m) are blanketed with pelagic mud. According to the blocks found on the lower slopes, the rocks that underlain these mud belong to the tertiary sedimentary cover of the Internal Zones of Calabria Peloritan Mountains of Sicily and Kabylia (CPK). The lower slopes are sediment-free. Their basement is composed of paleozoic granitoïdes and metamorphic rocks of CPK origin [2]. Where they run parallel to the channel strike (NE-SW), their surface is roughly planar and the basement is covered extensively with scree deposits a few meters thick. The scree are composed of blocks from the CPK basement and its sedimentary cover. The lower slopes are cut by deep, narrow canyons carved into the basement rocks..

If the scree deposits and narrow canyons were Messinian in age, they could be used to ascribe a post-messinian age to the neotectonic ridges. However, both the scree deposits and the canyons could as well result from gravitational submarine reworking of the messinian scarps.

To test the messinian hypothesis, we have measured the ^{10}Be and ^{26}Al contents of the scree deposits and canyons walls.

The use terrestrial *in situ* cosmogenic nuclides for tracing and dating

Production within the terrestrial crust of cosmonuclides such as ^{26}Al and ^{10}Be, whose half-life are 710 and 1500 ky, respectively, is limited to the upper few meters of the Earth surface. Since in the ocean rocks are completely shielded from cosmic rays at depths of several tens of meters, the in situ-produced cosmonuclides can be used as tracers of previous exposure to cosmic rays at the Earth surface. If the submarine erosion of surface previously exposed onshore is low and the initial aerial exposure time is high, the in situ-produced cosmonuclide concentrations should indeed remain measurable.

Furthermore, the time elapsed since the inception of shielding can be inferred from the differential radioactive decay, of ^{26}Al and ^{10}Be [e.g.3]. It is thus possible to test if the exposure occurred during the Messinian.

Sampling strategy and preliminary results.

^{10}Be and ^{26}Al have been extracted from quartz crystals from five blocks sampled on the Cornaglia Terrace southern scarp. Three different settings were selected: the basement surface, its scree cover, and the canyons carved into the basement. Three samples are blocks coming from the scree deposits: a sandstone of the CPK basement cover, a pegmatite from the CPK basement, and a quartzite. The basement surface and canyon wall samples are granite slabs.

When writing this abstract, reliable ^{10}Be measurements have only been performed on the basement surface and on the sandstone from the overlying scree. However, these preliminary results are quite promising. The ^{10}Be concentrations are significantly higher than those of the processed blanks. This demonstrates that, outside the canyons, the submarine landscape did not evolved significantly since its exposure to atmospheric weathering. However, given the low concentration of ^{10}Be in both samples, the ^{26}Al/^{10}Be ratio will not be measurable if exposure took place during the Messinian.

We expect the other samples to help us 1/ to demonstrate, that the exposure is messinian in age and 2/ to determine whether the canyons are submarine or continental features. We also will try to confirm that the crystal cores have not been polluted by seawater ^{10}Be.

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