

## Late Cenozoic fossil cold-water coral concentrations and mounds on the Argentine continental margin, Southwest South Atlantic

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**Abstract:** Fossil (Late Pleistocene) assemblages of cold-water corals (*Scleractinia*) were collected in the northern sector of the Argentine continental margin. After discussing its characteristics and setting it is considered that they were controlled by the influence of the high-energy interface between water-masses at the base of the Antarctic Intermediate Water on a hard substrate at the head of Mar del Plata canyon.

**Key words:** Cold-water corals, Argentine margin, AAIW, Mar del Plata canyon, contourites.

Cold-water coral (CWC) ecosystems are among the richest biodiversity hotspots in the deep sea, providing shelter and food for hundreds of associated species. Recent investigations have shown that extensive CWC ecosystems exist along the Argentine continental margin (ACM). A common point of discussion concerns the driving forces regarding the initiation of these complex systems. Both oceanographic boundary conditions (salinity, temperature, nutrient availability, current speed) and geological (i.e. hardground availability) processes have been proposed to play a significant role in the CWC nucleation, growth and decline. An intriguing question is to what extent the occurrence of CWC reefs along the Southwestern Atlantic margin (SWAM) is related to the pathway of the Antarctic Intermediate Water (AAIW).

Records of fossil Cenozoic CWC are extremely scarce in the SWAM. However, in the last few years CWC fossil concentrations of Late Pleistocene age were found in deep sea cores from the northern sector of the ACM (Fig. 1). Based on acoustic (multibeam images), sampling (deep-sea cores) and oceanographic data, a morphosedimentary characterization as well as water masses definition have been carried out in order to analyze the main factors controlling the growth and distribution of fossil CWC. We intent to determine: (i) the spatial distribution of the fossil CWC concentrations in the northern sector of ACM; (ii) the influence of the Antarctic Intermediate Water (AAIW) on the distribution of the CWC; and (iii) the role of the hydrodynamic pattern generated flow impinging the slope topography in the spatial distribution of the fossil CWC concentrations.

The northern sector of the ACM includes a huge contouritic depositional system (CDS) which potentially is a relevant indicator for the interaction between ocean dynamics and the sea floor (Hernández Molina *et al.*, 2009). The CDS (including terraces, drifts and channels) was generated by long-lasting contour-parallel currents whose strengths and boundaries were forced by variations in climate and sea level since the Miocene.

In the middle slope of the northern sector of the ACM two major terraces result in a step-like slope morphology: La Plata Terrace -T1- and Ewing Terrace -T2- (Fig. 2).

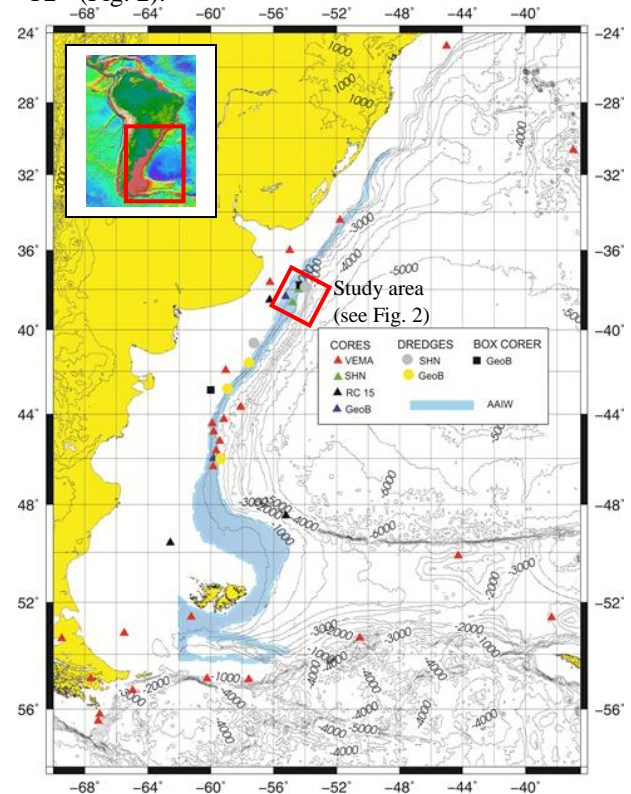


FIGURE 1. General bathymetry of the ACM, depths of influence of the AAIW (light blue area) and location of samples containing corals.

Especially the latter encompasses significant sediment accumulation. The Mar del Plata Canyon (MPC) intersects the Ewing Terrace. This canyon originates at ~1000m water depth cutting transversally into the middle slope and reaching the foot of the lower slope. The canyon's head ends upslope at the foot of an erosive steep slope that marks the transition between both terraces. The intermediate circulation in this sector is conditioned by the northward flowing of the Antarctic Intermediate Water (AAIW) and of the two

Circumpolar Deep Water (CDW) fractions: the Upper (UCDW) and the Lower (LCDW). Several geological-geophysical cruises on board the R/V Puerto Deseado (Ministry of Defense - CONICET) have been carried out since 2002. A suite of piston cores and dredges were obtained at the northern sector of the ACM containing modern and fossil isolated scleractinians, but in two cores at the outer border of the Ewing Terrace, near the head of the MPC (Fig. 2), scleractinians form fossil concentrations: core SHN-T300 (219cm long; 37°48.4'S - 54°20.1'W, 1300m water depth) and core SHN-T372 (115cm long, 38°00.3'S - 54°24.9'W, 1208m water depth).

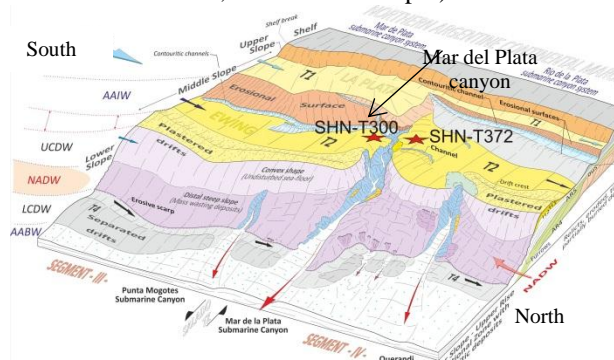


FIGURE 2. 3-D map of combined morphosedimentary and hydrographic features around Mar del Plata canyon in the northern sector of the Argentine continental margin (after Preu *et al.*, 2013).

Besides, the search of other references to available samples (cores, dredges and box-corers) in the ACM led to the finding of 41 sites (Fig. 1) containing corals, sampled during cruises from Lamont-Doherty Earth Observatory and Bremen University. However, only cores SHN-T300 and SHN-T372 contain fossil CWC concentrations. Scleractinian belong to *Bathelia candida* Moseley, 1881. A matrix-supported fossil concentration was found in the uppermost 23cm of core SHN-T372 in olive-grey massive mud. In core SHN-T300 eight discrete levels of corals were observed in the upper 90cm. In this core, echinoderm spines, benthic and planktonic foraminifera, ostracods, radiolarians and sponge spicules were found accompanying corals between 55 and 68cm. Micropaleontological (planktic foraminiferal) analyses of coral-bearing levels indicate a typical upper Pleistocene assemblage dominated by transitional species in a bathyal context.

*Bathelia candida* is considered as a species needing hard substrate to settle. Nowadays it is distributed from southern Brazil to southernmost Argentine margin where it usually forms small aggregates or “coral gardens”. Bathymetric distribution (500 to 1600m depth) roughly coincides with the location of the AAIW on the ACM. Fossil concentrations were found only on the Ewing terrace around the head of the MPC. The sampling location is presently near the transition between the AAIW and the underlying UCDW. Probable semi-buried mounds were recognized with multibeam images near the canyon flank. In this sector, contourite channels were recognized related to the turbulent boundary between AAIW and the UCDW

(Fig. 3). Considering age and bathymetry of the fossil CWC concentrations and hydrographic and geomorphologic context, based in the position of the AAIW during LGM according to Preu *et al.* (2012), we conclude that development, growth and distribution of CWC mounds in the northern sector of the ACM were probably controlled by the following environmental factors: (i) the exposure of hard substrates necessary for the initial settling of cold-water coral larvae around the head of the Mar del Plata canyon, possibly related to stronger bottom water currents during LGM times; (ii) the turbulent boundary between the AAIW and the UCDW water masses that control the transport of coral larvae along the SW Atlantic continental margin; (iii) the turbulences created by the interface AAIW/UCDW impinging the surface of the Ewing Terrace, creating suitable currents and substrate that favor intrusion of the nutrient afflux from Patagonian margin and allowing coral colonies to growth.

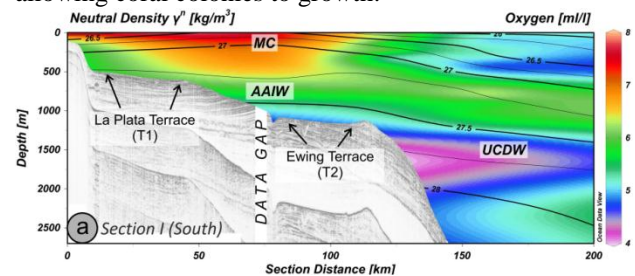


FIGURE 3. Seismic-hydrographic section close to the southern flank of Mar del Plata canyon, showing the influence of the water-masses on the terraces morphology (after Preu *et al.*, 2013).

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