Mar Biodiv (2012) 42:411–414
DOI 10.1007/s12526-012-0115-6

SENCKENBERG

SHORT COMMUNICATION

Deep-water coral reefs from the Uruguayan outer shelf and slope

Alvar Carranza · Araceli Muñoz Recio · Marcelo Kitahara · Fabrizio Scarabino · Leonardo Ortega · Guzmán López · Paula Franco-Fraguas · Camila De Mello · Juan Acosta · Antia Fontan · GRUPO MIGUEL OLIVER URUGUAY 0110

Received: 6 November 2011 / Revised: 30 January 2012 / Accepted: 14 February 2012 / Published online: 14 March 2012

Abstract We report the finding of monospecific scleractinian (i.e. *Lophelia pertusa*) reefs from the Uruguayan outer shelf and slope during an exploratory joint research cruise onboard the R/V 'Miguel Oliver' during January–February 2010. Acoustic mapping of the seafloor allowed the detailed analysis of 8,944 km^2, where some 17 structures identified as mounds were detected. Isolated cusps or groups of small mounds were the two main morphologies observed. Mound summit depths ranged from 167 to 326 m. The average height of the mounds was 35 m, reaching a maximum of 67 m. In all sampled mounds, the presence of live coral and/or coral rubble was detected, while absent from surrounding soft sediment bottoms. Some mounds were associated with fluid seepages. This is the first report of deep-sea coral reefs on the Uruguayan continental shelf and slope, and represents the southernmost Western Atlantic shelf and slope record of *L. pertusa* to date.

Keywords Deep sea coral reef · *Lophelia* · Southwestern Atlantic · Uruguay

Vicente Alfajeme Benítez-Cano, Fernando Andrade, Miguel Ángel Bécares Baruque, Ricardo Gómez de Paz, Patricia Jiménez, Yamandú Marín, and Luis Rubio are members of the Grupo Miguel Oliver Uruguay 0110

A. Carranza (✉) · F. Scarabino
Museo Nacional de Historia Natural,
CC. 399, CP 11000 Montevideo, Uruguay
e-mail: alvardoc@fcien.edu.uy

A. Carranza · F. Scarabino · L. Ortega · G. López ·
P. Franco-Fraguas · C. De Mello
Dirección Nacional de Recursos Acuáticos,
Constituyente 1497,
CP 11200 Montevideo, Uruguay

A. M. Recio · A. Fontan
TRAGSA-Secretaria General del Mar,
Núñez de Balboa, 116,
28006 Madrid, Spain

M. Kitahara
School of Pharmacy and Molecular Science,
Coral Genomics Group, James Cook University,
Molecular Science Building Annex, Douglas 4811,
Townsville, QLD, Australia

J. Acosta
Instituto Español de Oceanografía,
Corazón de Maria, 8,
28002 Madrid, Spain

Knowledge on deep-sea coral reefs is rapidly expanding due to the availability of new technologies well suited for the detection of the structures formed by colonial scleractinians. Deep-water coral reefs are currently known from the Mediterranean, northeastern Atlantic, northwestern Atlantic, Gulf of Mexico, southeastern Atlantic, southwestern Atlantic and Antarctic and Subantarctic waters (Roberts et al. 2006). However, the presence of these structures may be widespread, probably occurring to some degree, and formed by different species, in most continental margins globally (Roberts et al. 2006).

In this vein, we report here the finding of monospecific scleractinian bioherms formed by *L. pertusa* from the Uruguayan outer shelf and slope. These reefs were discovered during a joint research cruise of the Spanish Secretariat General of the Sea (SGM) and the National Direction of Aquatic Resources from Uruguay (DINARA) carried out onboard R/V 'Miguel Oliver' during January–February 2010.

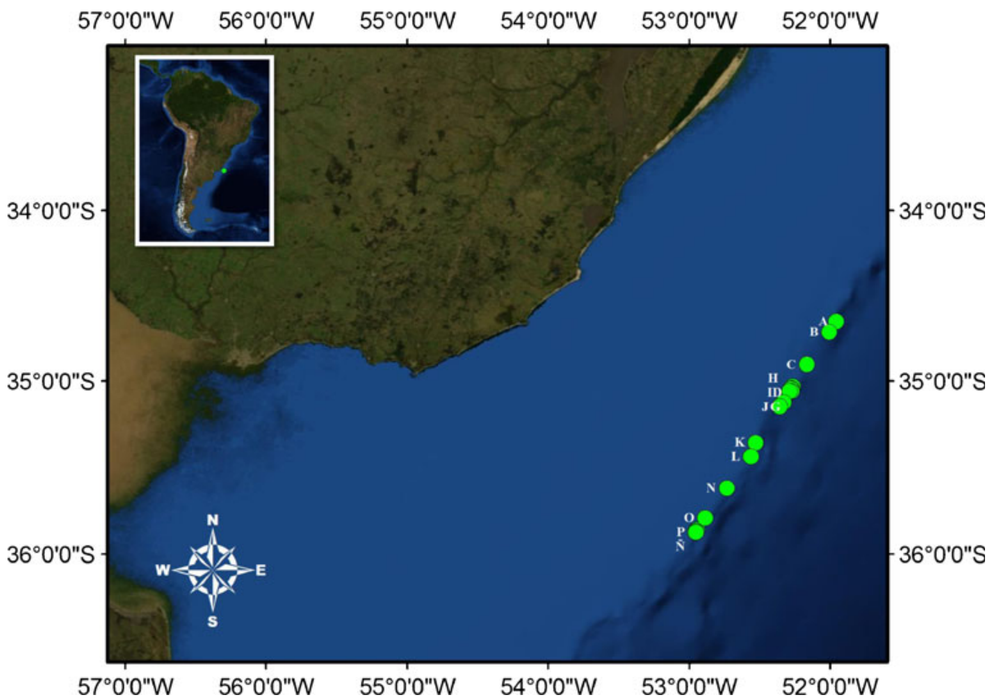

Fig. 1 Location of the identified mounds (*A*–*P*) where coral reefs were detected on the Uruguayan outer shelf and slope

The surveyed area included a fringe located between depths of 200 and 1,000 m in the Uruguayan outer shelf and slope. This area is influenced by fronts originated by the confluence of Subtropical Shelf Waters and the Subantarctic Shelf Waters (Martos and Piccolo 1988; Lutz and Carreto 1991; Ortega and Martínez 2007) and the surface influence of the Río de la Plata estuary, supplying a low salinity buoyant layer that may reach up to 30 m during periods of extreme continental runoff (Ortega and Martínez 2007).

During the cruise, bathymetrical and geophysical data were acquired using two hull-mounted systems, namely a Kongsberg-Simrad EM 302 multi-beam swath-bathymetry

Table 1 Mounds, location, latitude (S) and longitude (W) (in decimal degrees), maximum length, width and height, morphology, summit depth and sampling

Mound	Latitude	Longitude	Max length (m)	Max width (m)	Max height (m)	Morphology	Summit depth (m)	Sampled
A	−34.649	−51.956	402	394	56	IMwE	302	Yes
B	−34.711	−52.004	367	260	60	IMwE	311	Yes
C	−34.902	−52.162	207	183	23	IMwE	288	No
D	−35.031	−52.261	169	131	26	IM	278	No
E	−35.041	−52.268	302	268	40	IMwE	268	Yes
F	−35.045	−52.274	270	193	43	IMwE	245	Yes
G	−35.058	−52.272	175	137	23	IMwE	326	No
H	−35.058	−52.286	157	102	20	IM	249	No
I	−35.122	−52.328	712	260	67	AM	233	Yes
J	−35.148	−52.355	605	313	49	AM	239	Yes
K	−35.357	−52.524	107	88	24	IMwE	283	Yes
L	−35.437	−52.559	1,349	967	43	AM	250	Yes
M	−35.861	−52.943	369	286	10	IM	236	Yes
N	−35.619	−52.730	304	175	6	AM	199	Yes
Ñ	−35.870	−52.949	174	159	34	IM	227	Yes
O	−35.791	−52.886	1,772	559	37	AM	167	Yes
P	−35.874	−52.951	174	162	37	IM	229	Yes

IMwS Isolated mound with escarpment, *IM* isolated mound without escarpment, *AM* aggregated mounds

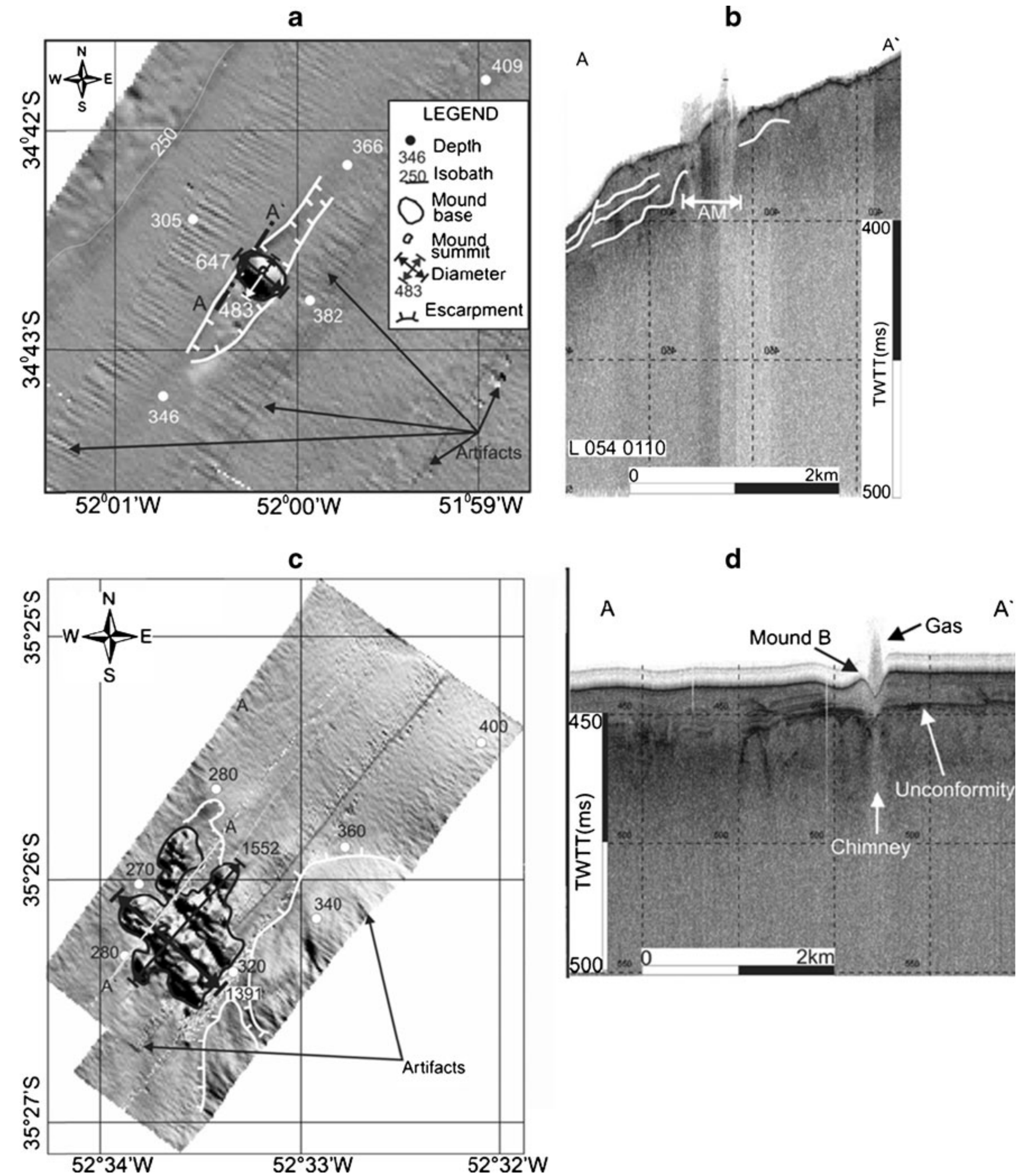

Fig. 2 Digital Terrain Model and seismic profile of two mounds showing characteristic features, depth, size references and location of seismic lines. Note the associated gas chimney and Acoustic Masking (*AM*). **a**, **b** Mound "B"; **c**, **d** Mound "L"

system and a Topographic Parametric Sonar (TOPAS) PS 18 sub-bottom profiler. Swath data were processed through the removal of anomalous pings and gridded at cell sizes of 50 m using MB-System (Caress and Chayes 2008) software. Sea bottom water temperature and salinity were measured using a SBE 25 SEALOGGER CTD. Biological data were acquired using a rock dredge that consisted of a rectangular metal structure, coupled with a 10-mm mesh size net protected by a rubber base.

Acoustic seafloor mapping allowed the detailed analysis of 8,944 km^2. Some 17 structures identified as mounds were detected, and 14 were sampled using the rock dredge (Fig. 1; Table 1). In all samples, live coral and a variable amount of coral ruble was detected. The mounds presented two main morphologies: isolated cusps or groups of small mounds. Mounds summit depths ranged from 167 to 326 m, the average height of the mounds being 35 m, reaching a maximum of 67 m. Sea bottom water temperature averaged

Fig. 3 *Lophelia pertusa* collected off Uruguayan waters. *Scale bar* 10 cm

9.7°C along the sampled mounds, indicating the dominance of Subantarctic Water and South Atlantic Central Waters. The presence of the mounds has facilitated the erosion of the seafloor creating an elongated, depressed topography around the mounds (Fig. 2a, c). This erosion is more evident around the isolated cusps morphologies. Seeping fluid and/or gas discharge were often associated with the mounds, as can be seen both in the water column and the acoustic turbidity below the seafloor in the TOPAS profiles (Fig. 2c, d).

The nearest reports on the occurrence of *L. pertusa* (Fig. 3) come from the neighboring waters off Rio Grande do Sul, Brazil, and are restricted to occurrence data (Kitahara 2006, 2007; Kitahara et al. 2008, 2009). In addition, since recent observations from Patagonian waters indicate that *Bathelia candida* is the primary reef-building scleractinan species (Muñoz et al. 2012), our observations might represent the southernmost western Atlantic record of *L. pertusa* reefs. Furthermore, the Uruguayan reefs are amongst the shallowest Atlantic records (146 m off northern Florida; Cairns 2000). This can be related to the relatively shallower depth of the Aragonite Saturation Horizon (ASH) that ranges in depth between 100 and 200 m in the Uruguayan continental shelf and slope. Besides the ASH, other possible environmental factors closely related with these relatively shallow records may include the distribution of fluid seepages (Hovland 2005) and the particular regional hydrology (Frederiksen et al. 1992). Future work should focus on the assessment of reef health to provide recommendations for the immediate delimitation of fishery protected areas aimed at conserving these delicate structures.

Acknowledgements We would like to express our gratitude to the crew of the R/V 'Miguel Oliver'. Financial support from SGM/IEO (Spain) and DINARA (Uruguay) through UTF/URU/025/URU is acknowledged. W.S. Serra is acknowledged for image processing.

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