

Antropoquinas: o que o lixo no mar tem a ver com as geociências?

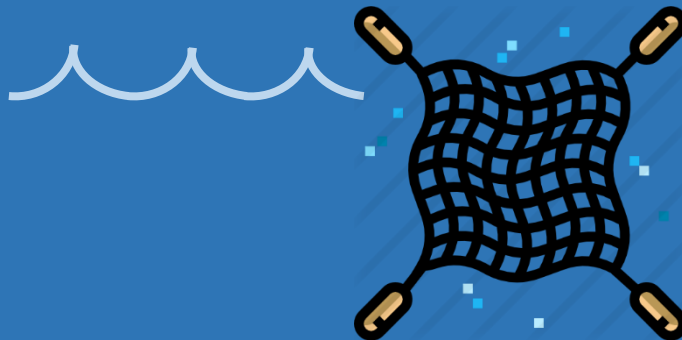
Projeto #junt@sadistância



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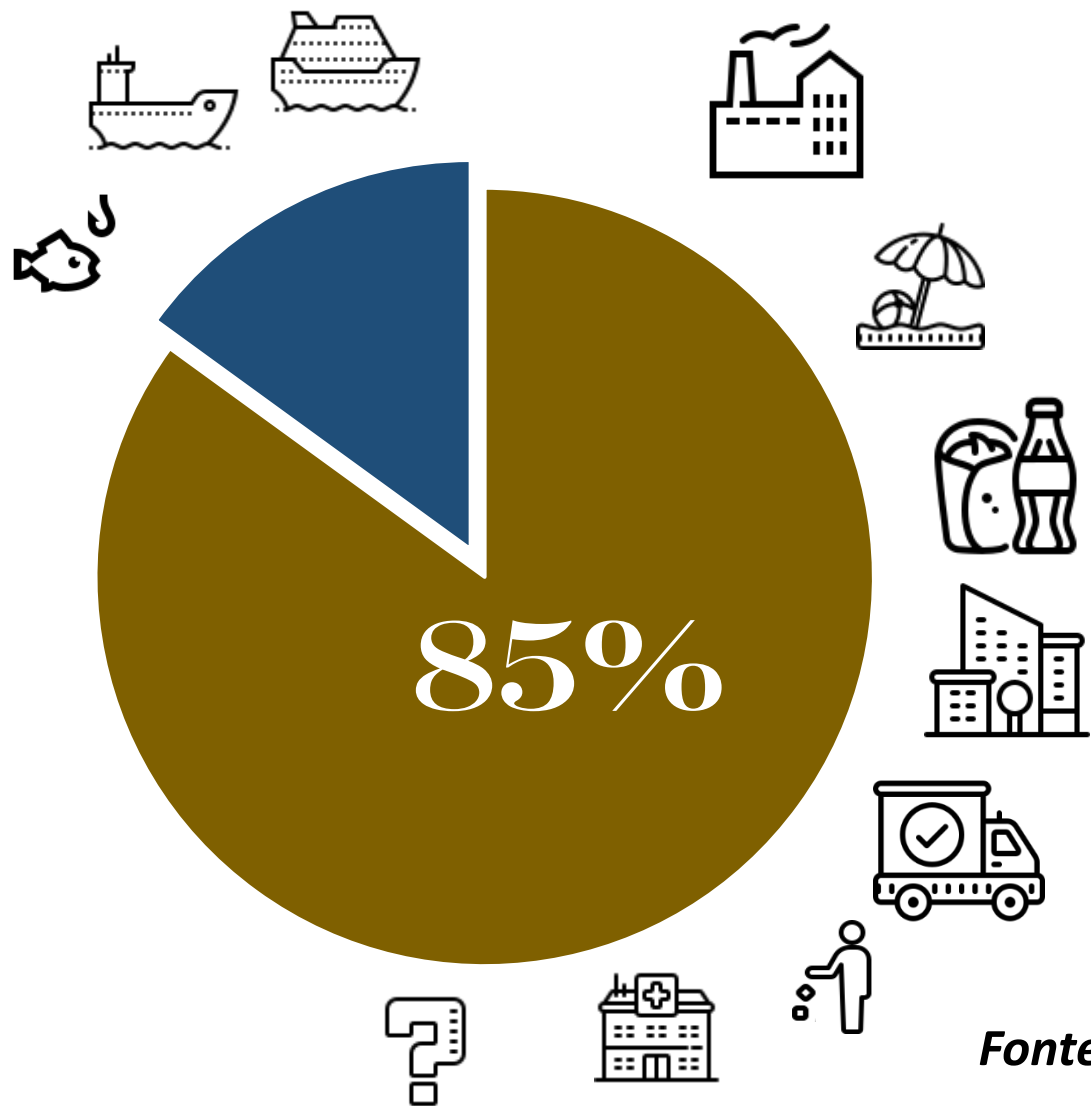


O QUE É LIXO NO MAR?



Fontes no mar

F
O
N
T
E
S



Fontes em terra

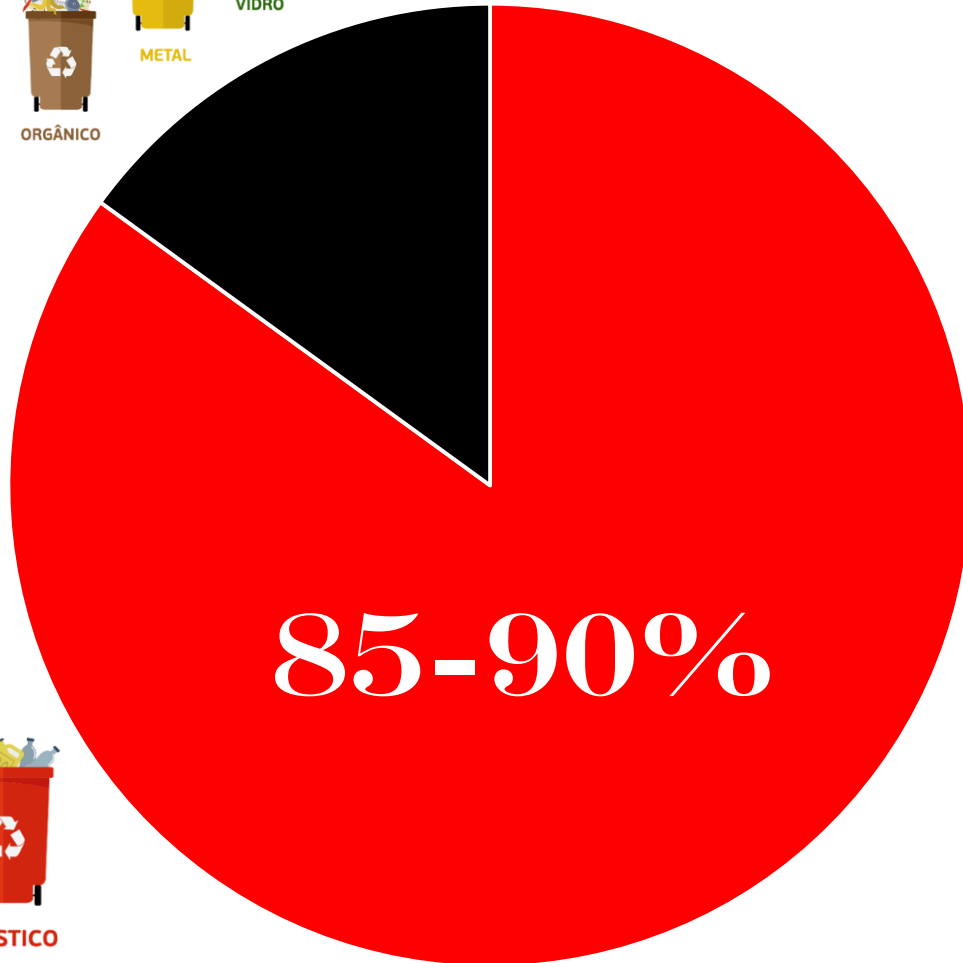
<https://icons8.com/>

ORGÂNICO

METAL

VIDRO

PAPEL



PLÁSTICO



Modificado de UNEP, 2018

Lixo na biota



Chris Jordan

Lixo flutuante



Fonte: Google

Lixo bentônico

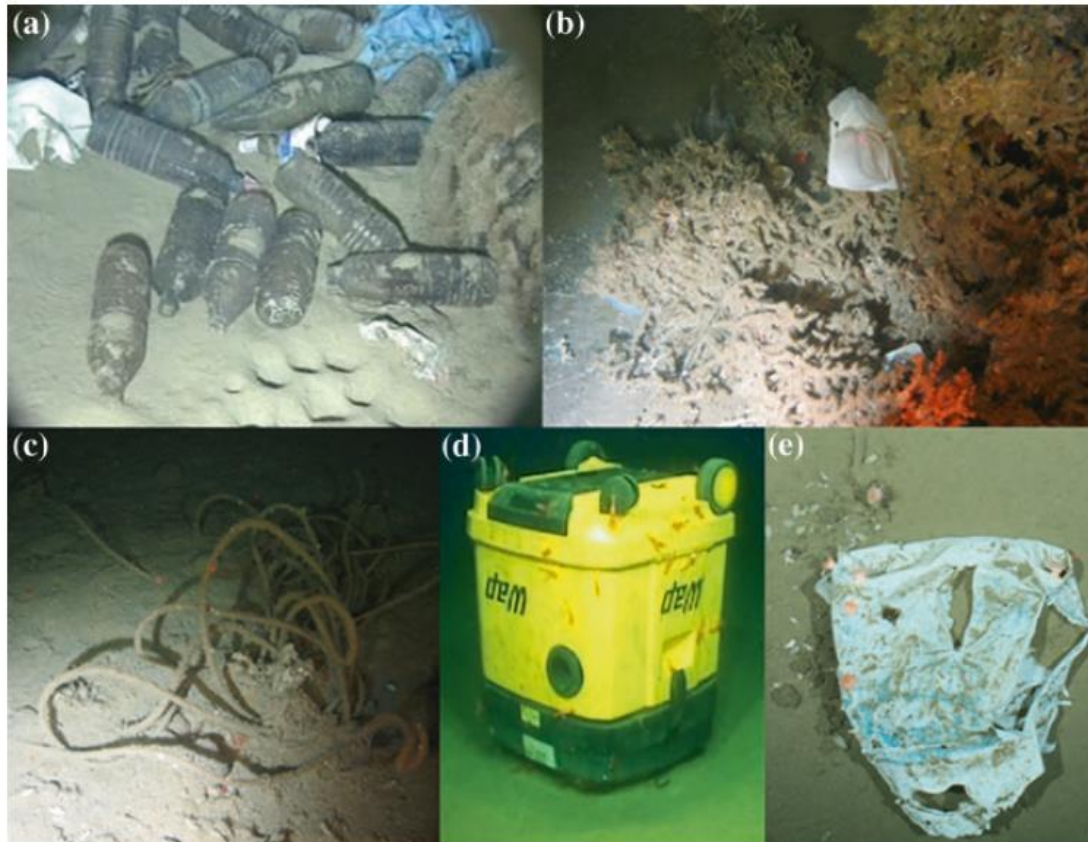


Fig. 2.2 Litter on the deep seafloor. **a** Plastic bags and bottles dumped 20 km off the French Mediterranean coast at 1,000 m in close vicinity to burrow holes (F. Galgani, IFREMER); **b** food package entrapped at 1,058 m in deep-water coral colony; **c** rope at 1,041 m depth, both from Darwin Mounds (courtesy of V. Huvenne, National Oceanography Centre Southampton (NOCS)); **d** waste disposal bin or a vacuum cleaner with prawns on the seafloor off Mauritania at 1,312 m depth (courtesy of D. Jones, SERPENT Project, NOCS); **e** plastic carrier bag found at ~2,500 m depth at the HAUSGARTEN observatory (Arctic) colonised by hormathiid anemones and surrounded by dead tests of irregular sea urchins (courtesy of M. Bergmann, AWI)

Galgani et al., 2015

Lixo em praias

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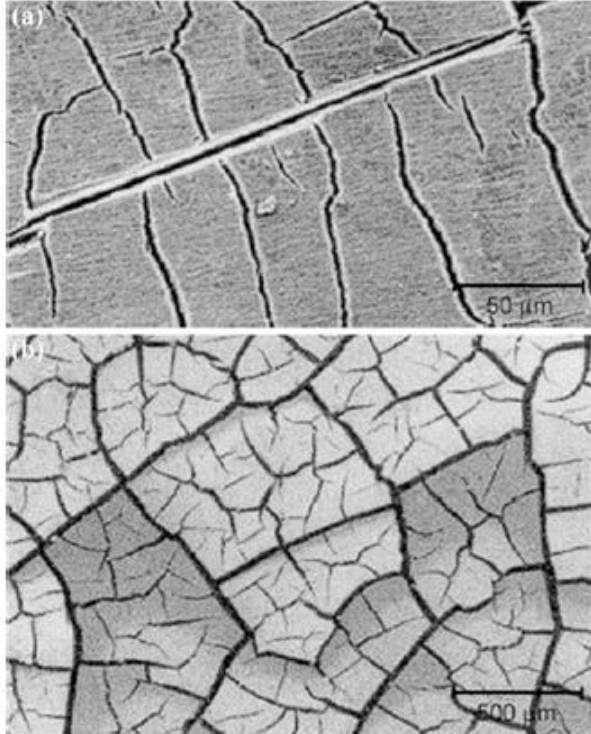


Praia de Amaralina, Salvador, 2013 (Créd. Gerson Fernandino)

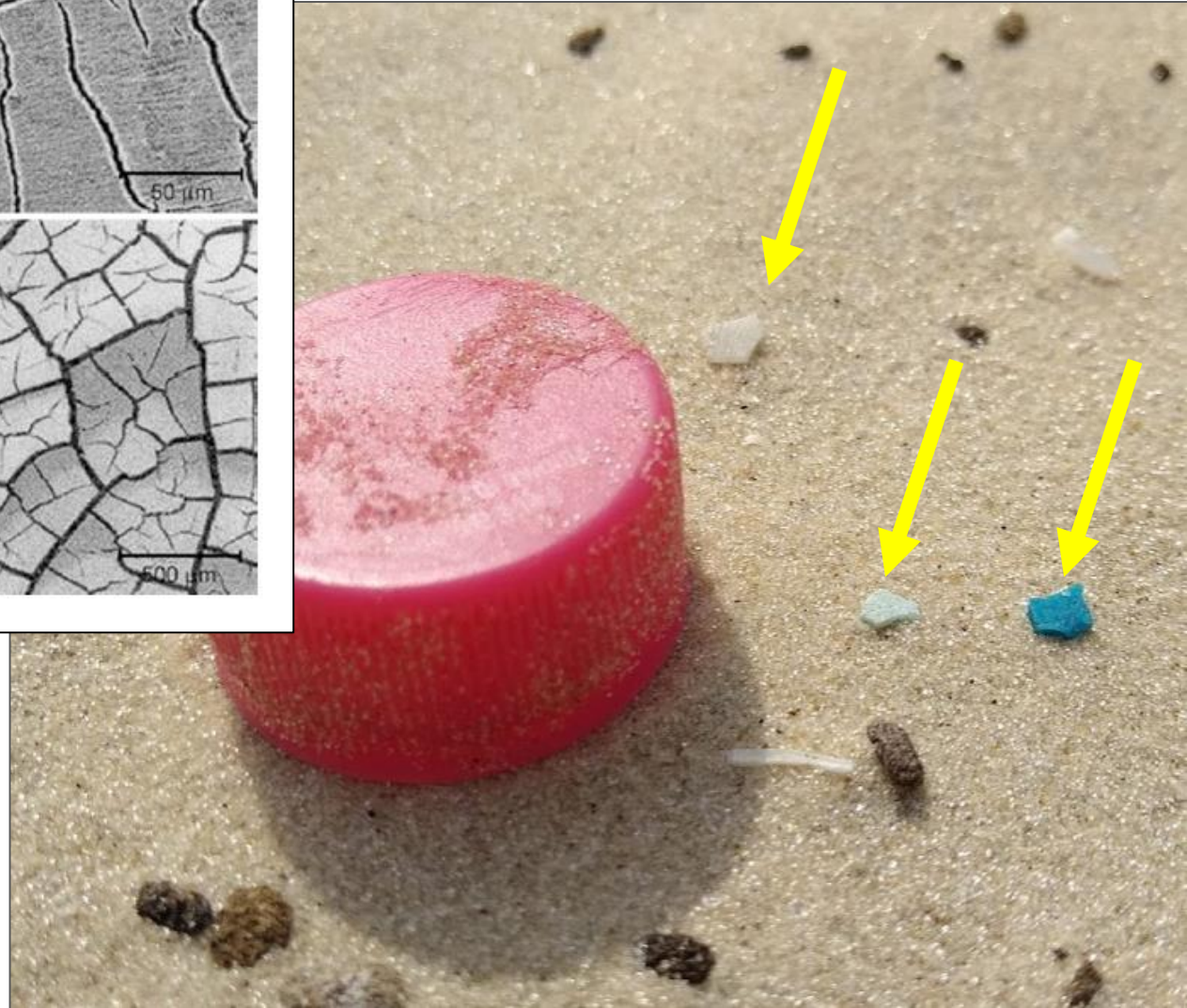
Microplástico

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Fig. 3.5 Development of visible cracks on exposure of LDPE samples to laboratory accelerated weathering. a Exposed to a xenon source (Atlas WeatherOmeter) for 1600 h at 63.5 °C and b exposed to a UV fluorescent lamp (QUV WeatherOmeter) for 800 h at 60.5 °C. Reproduced with permission from Küpper et al. (2004)

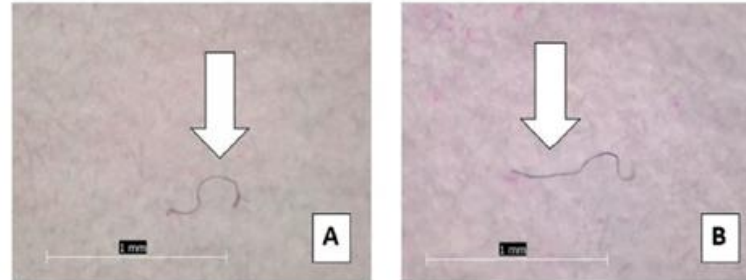


Modificado de Andrady, 2015.



Microplástico

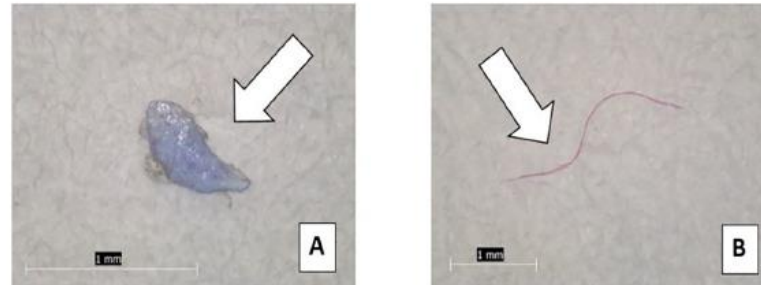
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Kosuth et al., 2018

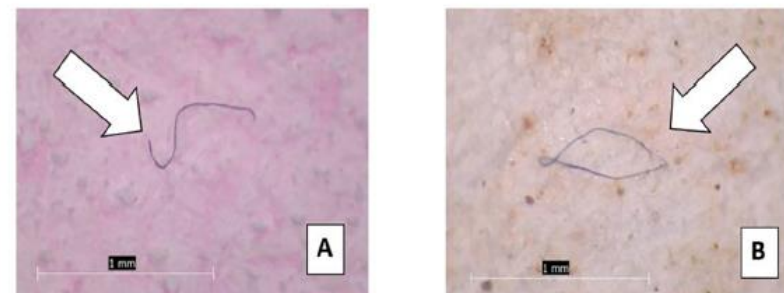
Fig 4. Beer particles. Examples of anthropogenic particles found in beer: (A) Fiber, 0.75 mm in length from brewery drawing water from Lake Ontario; (B) Fiber, 1 mm in length from brewery drawing water from Lake Erie.

<https://doi.org/10.1371/journal.pone.0194970.g004>



Kosuth et al., 2018

Fig 2. Tap water particles. Examples of anthropogenic particles found in tap water: (A) Fragment, 1 mm in length from Indian subcontinent; (B) Fiber, 2.5 mm in length from U.S. tap water sample.



Kosuth et al., 2018

Fig 6. Sea salt particles. Examples of anthropogenic particles found in sea salt: (A) Fiber, 1 mm in length from Pacific Ocean sourced sea salt; (B) Fiber, 1.5 mm in length from Atlantic Ocean sourced sea salt.



https://www.politico.eu/article/the-plastic-in-our-bodies-health/?fbclid=IwAR0GmYRcFfl-fqkrj6wkl0IaSRboB53_zhblhve2Ftu8WGyrb3R9f_mhmM



20 partículas de microplástico/10 g de fezes
(800-1000/dia)

Lixo/plástico em diferentes ambientes



Fig. 7.2 Sea ice core being collected during the NASA ICESCAPE expedition in July 2010
(Photo: D. Perovich, U.S. Army Corps of Engineers Cold Regions Research & Engineering)

Modificado de Thompson, 2015.

Antártica



veltra.com

Alpes



A Sherpa bags up litter on Mount Everest at 8,000 meters.
(Image: © Namgyal Sherpa/AFP/Getty)

Monte Everest

Lixo/plástico em diferentes ambientes

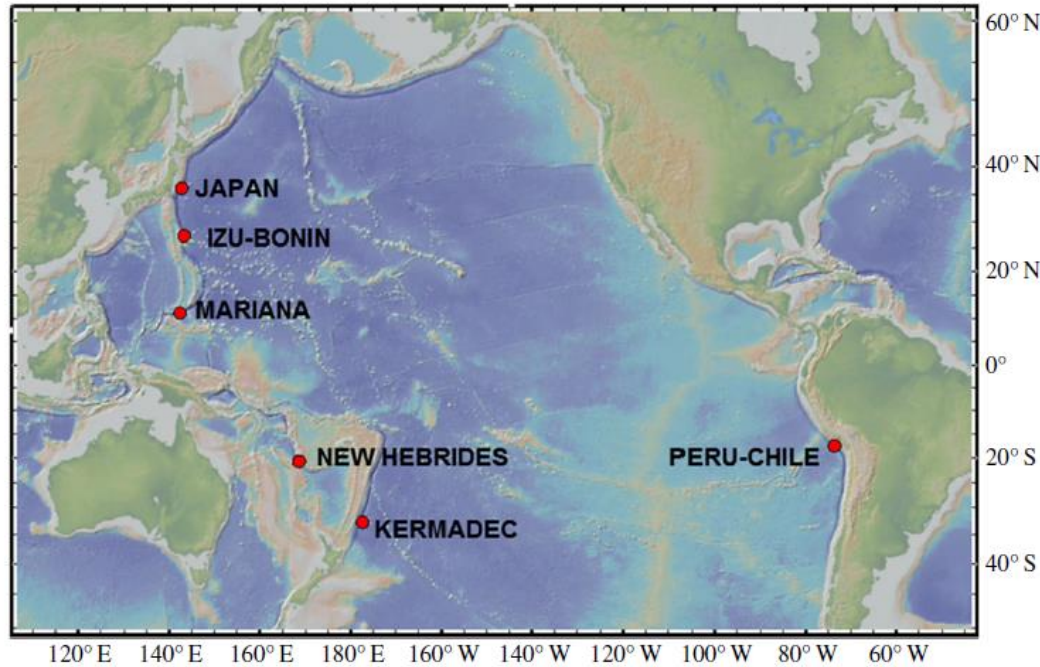


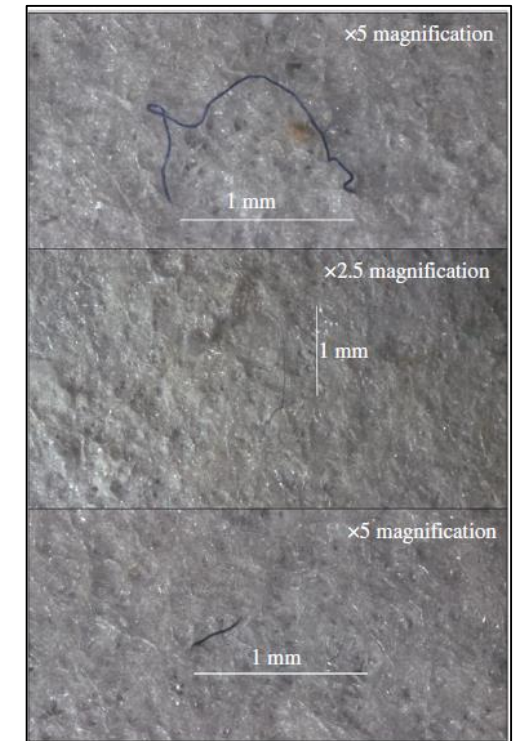
Figure 1. Locations of the six trenches around the Pacific rim where amphipods were sampled for microplastic ingestion. The sites include the Japan, Izu-Bonin and Mariana trenches in the northwest Pacific; the New Hebrides and Kermadec trenches in the southwest Pacific and the Peru-Chile Trench in the southeast Pacific.

royalsocietypublishing.org/journal/rsos R. Soc. open sci. 6: 180667

Fonte: Jamieson et al., 2019.



Figure 2. The three species of Lysianassoidea amphipods collected from six hadal trenches around the Pacific rim. (a) *Hirondelea gigas*, (b) *Hirondelea dubia* and (c) *Eurythenes gryllus*. Scale bar = 10 mm. * indicates position of coxa 4.



O 'Eurythenes plasticus' mostra as consequências 'de nosso manuseio inadequado de resíduos de plástico', de acordo com a WWF

Eurythenes plasticus (Weston et al., 2020).

Fossas oceânicas

Voltemos à praia...

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Jauá, BA. Ago2013 (Créd. Gerson Fernandino)

Voltemos à praia...

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Torres, RS, 2019 (Créd. Gerson Fernandino)

Voltemos à praia...

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Salvador, BA. 2012/13 (Créd. Gerson Fernandino)

Voltemos à praia...

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Porto Seguro, BA. 2016 (Créd. Gerson Fernandino)

Se não tivesse o lixo...

Sedimento

(componentes naturais)



Terrígeno/Alóctone: destaque para grânulos de feldspato e mica. Punta del Diablo, Set 2018



Matéria orgânica, Praia do Cassino, RS. (Foto: Heitor Francischini).



Marinho/bioclástico/Autóctone (Punta del Diablo, Uruguai).

Se não tivesse o lixo...



Sedimento praial (Salvador, BA).

Se não tivesse o lixo...



Siliciclástico

Sedimento praial (Salvador, BA).

Se não tivesse o lixo...

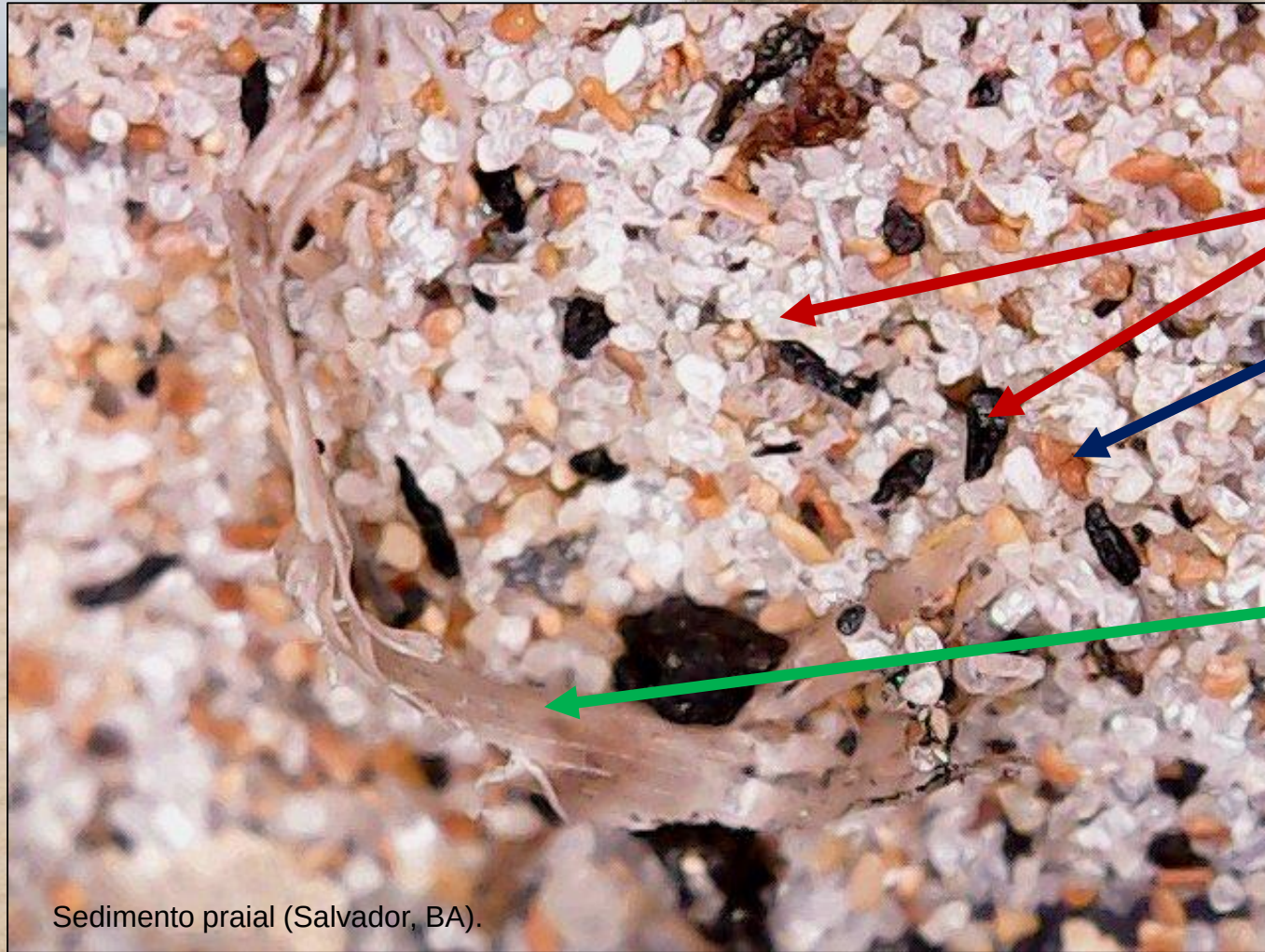


Sedimento praial (Salvador, BA).

Siliciclástico

Bioclástico

Se não tivesse o lixo...



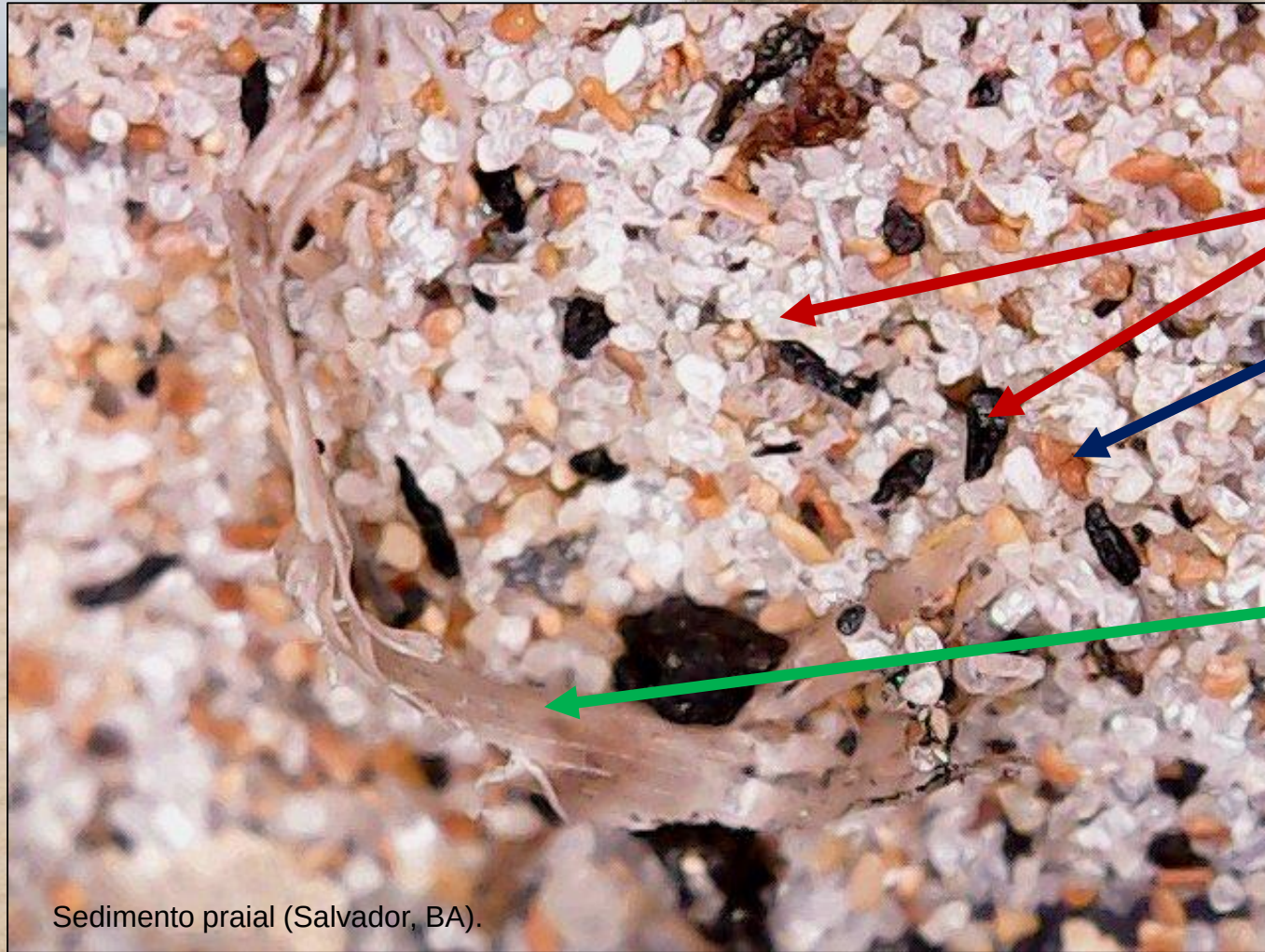
Sedimento praial (Salvador, BA).

Siliciclástico

Bioclástico

Orgânico

Se não tivesse o lixo...



Siliciclástico

Bioclástico

Orgânico

Sedimento praial (Salvador, BA).

O componente antropogênico do sedimento



Jardim dos Namorados, Salvador - BA

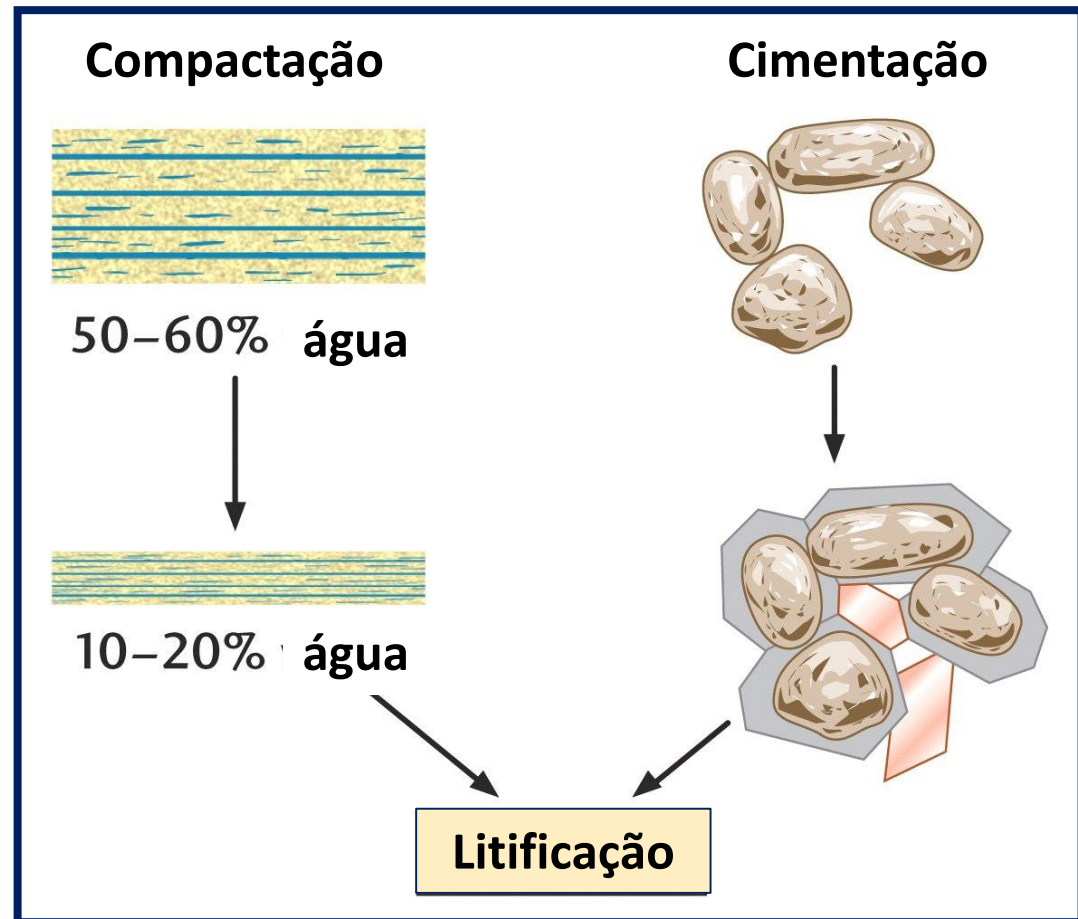
Diagênese + Litificação

- **Compactação**

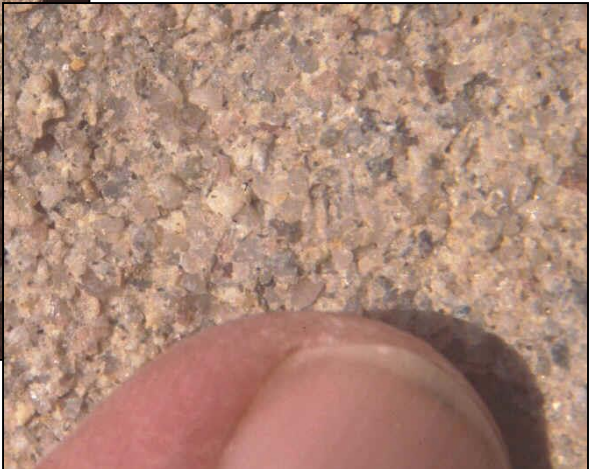
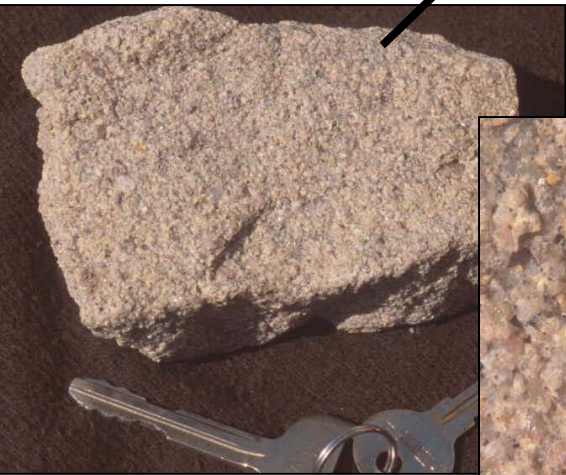
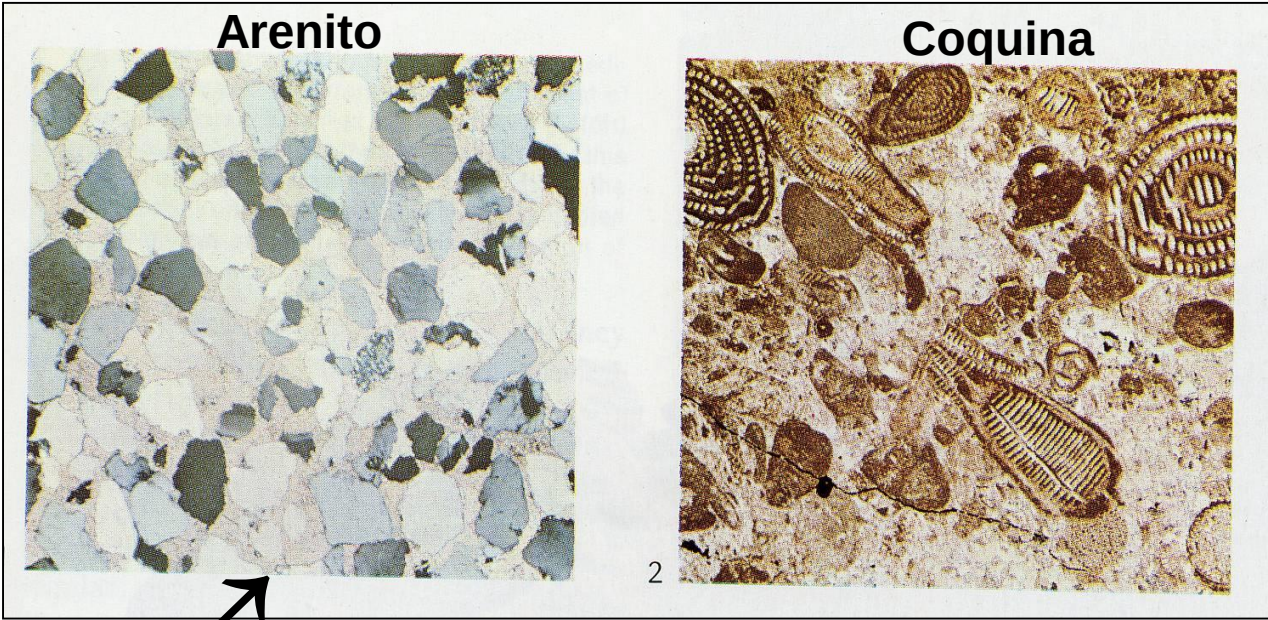
(< porosidade;
deformação;
entrelaçamento).

- **Cimentação**

(precipitados
químicos, como CaCO_3
e SiO_2 , unem as
partículas, podendo
gerar minerais
novos).



Composição e ambiente



Fonte: Modificado de Para Entender a Terra



Arenito de praia (*beachrocks*)



Fig. 3.16 Relatively well indurated beach deposits (beachrock) of the Pleistocene barrier outcropping at the modern foreshore of Bujuru



Nota:

Afloramento de arenito de praia no RS. Fonte: Dillenburg et al., 2009

Arenitos de praia são normalmente formados em ambientes tropicais, com alta disponibilidade de CaCO_3 . Sua formação em ambientes temperados ou subtropicais (como no RS) se difere bastante daqueles de ambientes tropicais.

Arenito de praia (*beachrocks*)

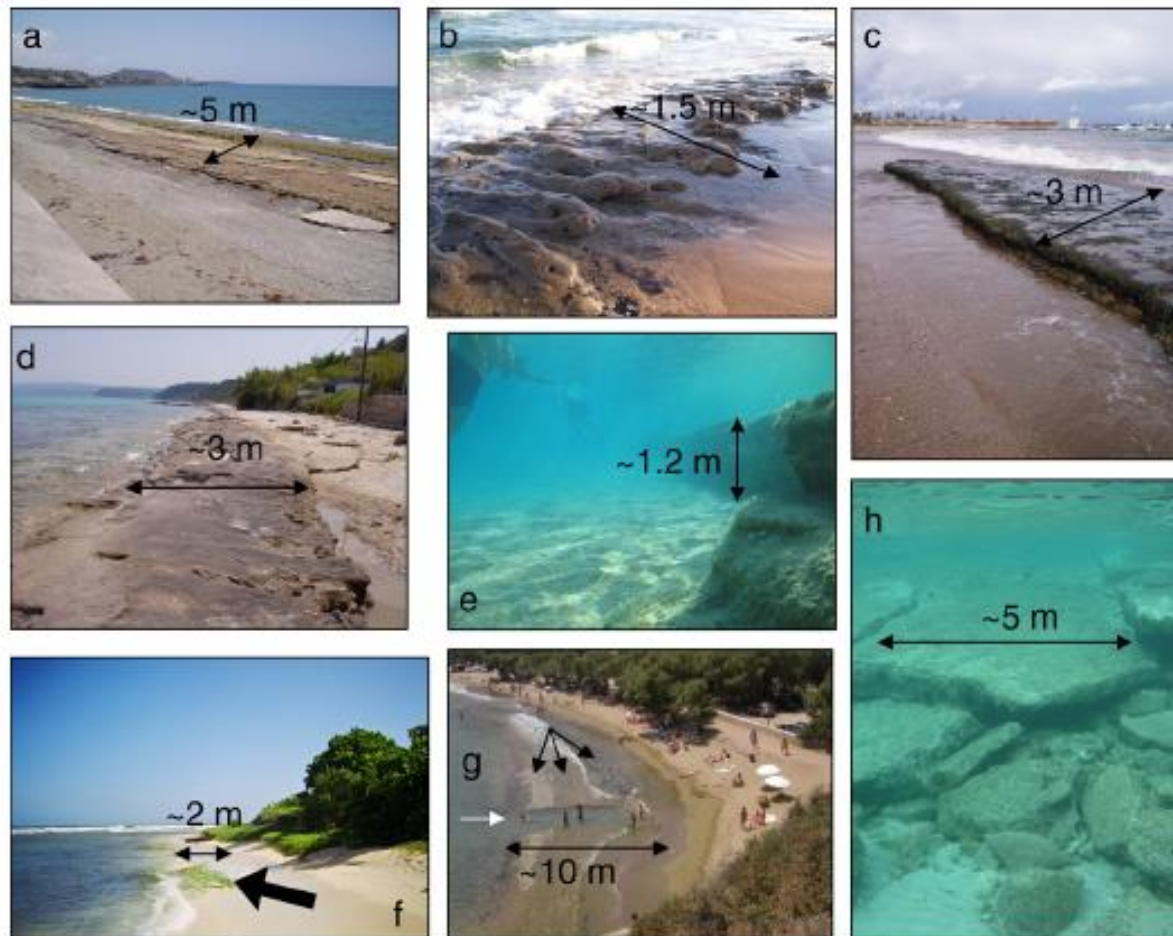
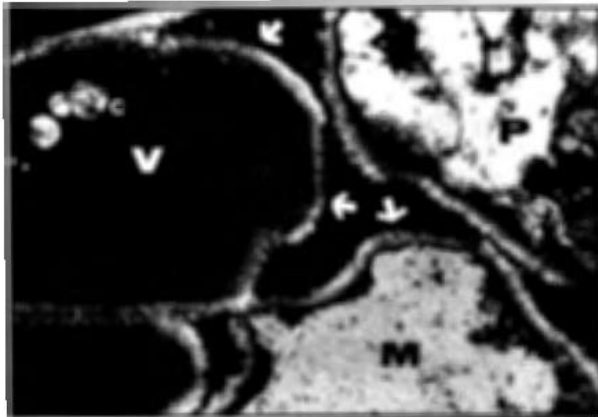


Fig. 1. Beachrocks: (a) Baracoa, Cuba; (b) Salvador, Bahia, Brazil; (c) Barcelona, Spain; (d) Athitos, N. Greece; (e) Mykonos Island, Greece; (f) Morrocoy, Venezuela; (g) Sifnos Island, Greece (the white arrow shows a corridor excavated into the beachrock outcrop to provide access to the sea, whereas the black arrows show the 3 different zones of colonising bio-communities (an inshore black, an inner yellow and an outer yellow zone, see Section 5.2); and (h) Attica, Greece (courtesy of I. Issaris).

Um olhar geológico sobre o lixo no mar



Fig. 19. El "beach-rock" subactual de la playa de Arrigúnaga (Algorta, Vizcaya). a) aspecto de campo de los niveles subhorizontales de la playa levantada; b) Microfotografía con nícoles cruzados. Se observan fragmentos de vidrio (V) (isótopos) con las vacuolas rellenas de calcita (c), granos de cuarzo mono- (M) y policristalino (P), y una cementación muy incipiente de aragonito fibroso-radial (cemento A) señalado por las flechas. La anchura del campo óptico es de 0.7 cm.



Vidro cimentado em arenito de praia (Garcia-Garmilla, 1990)
- Local: Vizcaya, Espanha

Um olhar geológico sobre o lixo no mar

Plastiglomerado (Corcoran et al., 2014):
- Local: Havaí

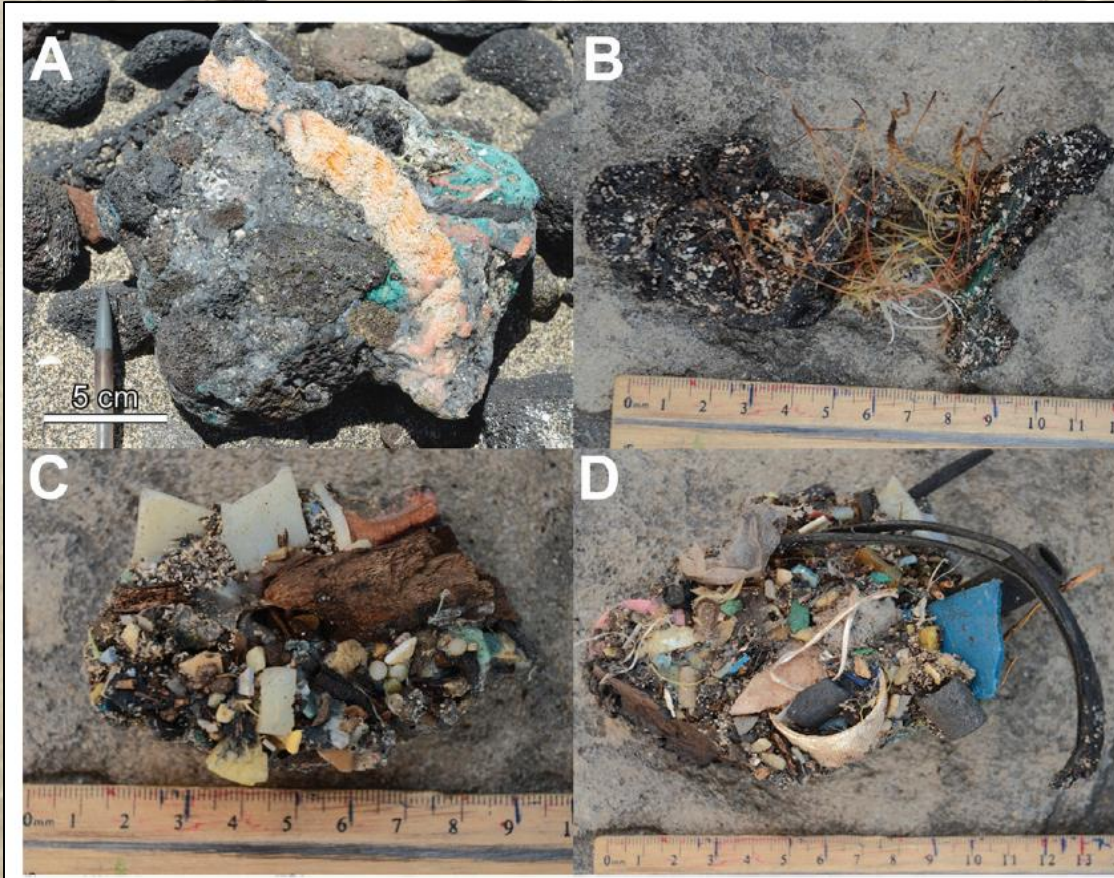


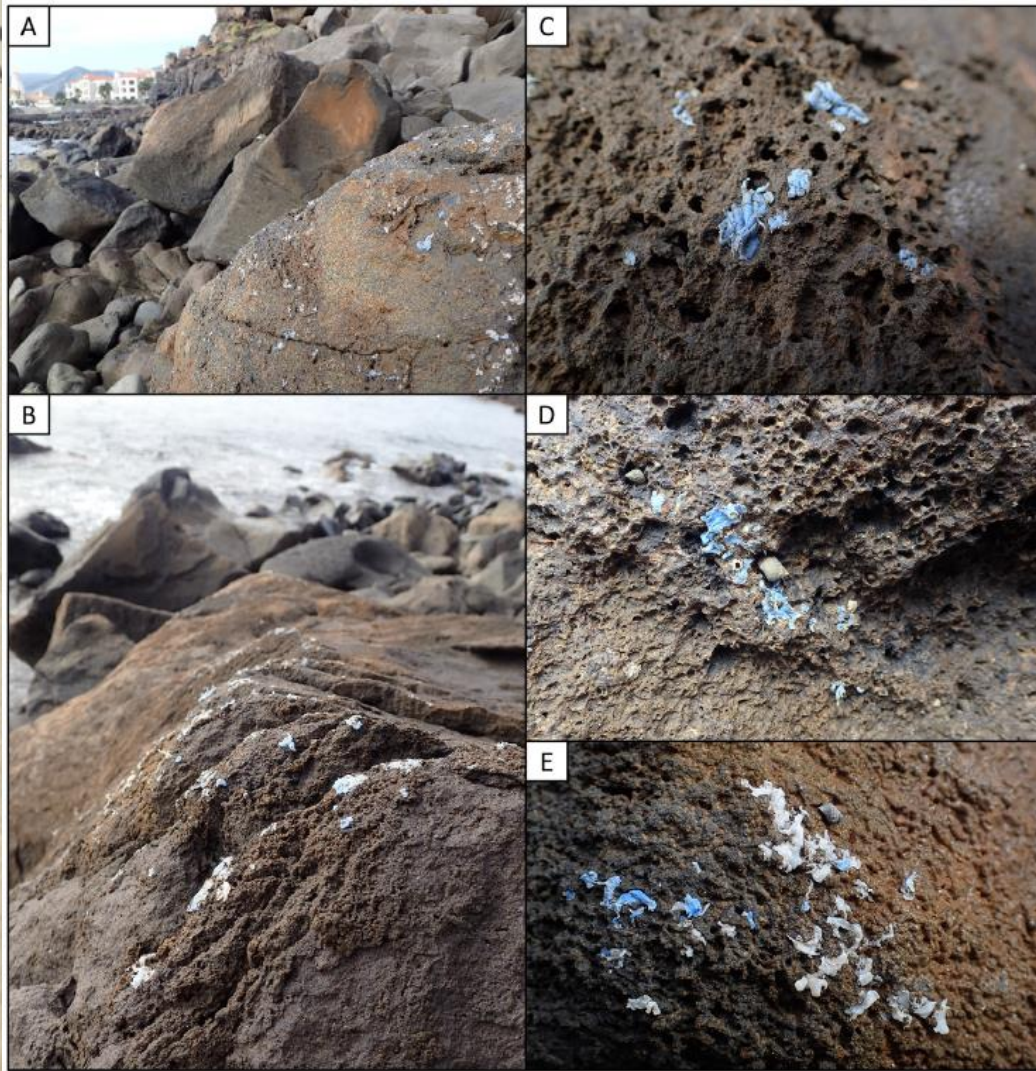
Figure 4. Photographs of clastic plastiglomerate on Kamilo Beach. (A) Subrounded fragment containing basalt clasts, molten plastic, yellow rope, and green and red netting. (B) Portions of black and green plastic containers adhered to basalt fragments and connected by netting. (C) Fragment containing plastic pellets and “confetti” with woody debris. (D) Adhered mixture of sand, black tubing, a bottle lid, “confetti,” netting, and part of a plastic bag.

Um olhar geológico sobre o lixo no mar

Fragmento plástico cimentado em arenito de praia (Fonte: Zalasiewicz et al., 2016)
- Local: Região Basca, Espanha



Um olhar geológico sobre o lixo no mar



Plasticrosta (Gestoso et al., 2019)
- Ilha da Madeira

Fig. 1. Pictures showing (A, B) a general overview of mid-upper intertidal rocky shore in Madeira Island encrusted by plastic; (C) detail of 'plasticrusts' on the surface of the rocks; and (D, E) view of 'plasticrusts' surrounded by the littorinid gastropod *Tectarius striatus*.

Um olhar geológico sobre o lixo no mar



Piroplástico (Turner et
al., 2019)
- sul da Inglaterra

Piroplásticos coletados na costa da Cornualha. Foto: ROB ARNOLD

Mas afinal, o que são antropoquinas?

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Baseline

Anthropoquinas: First description of plastics and other man-made materials in recently formed coastal sedimentary rocks in the southern hemisphere



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ABSTRACT

Plastic, as a “flagship species”, represents how deeply humans impact the environment. Although scarce, the presence of plastic and other anthropogenic materials in rocks has already been reported in the literature, however, so far, not in the Southern Hemisphere. Thus, the objective of the present study was to report and describe samples of sedimentary rocks containing anthropogenic items cemented with biogenic and siliciclastic material – anthropoquinas – and to discuss implications to the establishment of the Anthropocene and geodiversity conservation. Six samples of anthropoquinas were evaluated, presenting different technofossils (metal bottle caps, ship nail, plastic earring and plastic fragment) and composition (lithic and biogenic fragments). Energy Dispersive X-ray Spectroscopy was conducted on two samples, reflecting differences regarding their genesis. The description of these rocks is concerning and reflects how deeply human behavior influences various natural compartments. Therefore, studies on the effects of marine litter on geodiversity are strongly encouraged.

<https://authors.elsevier.com/a/1aikz,ashxIKu>

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Mas afinal, o que são antroquinas?

Antropo
(gr. *'anthropos'* = homem)



quina
(*alusão à coquina*)



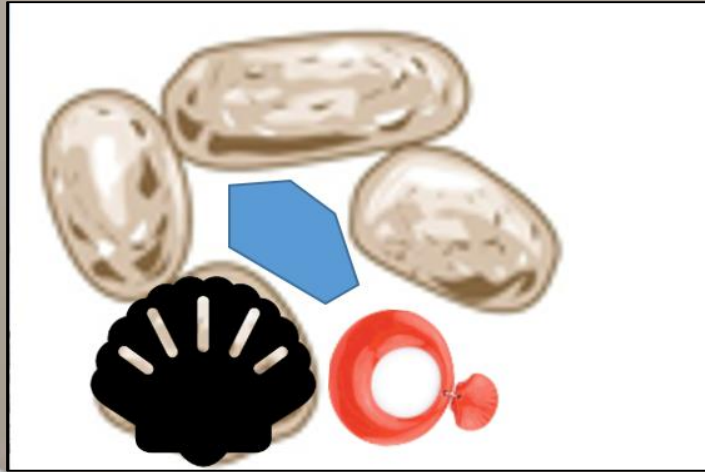
"Confeti" na praia de Tregante Cove, Newquay, Cornualha.. Cred PA



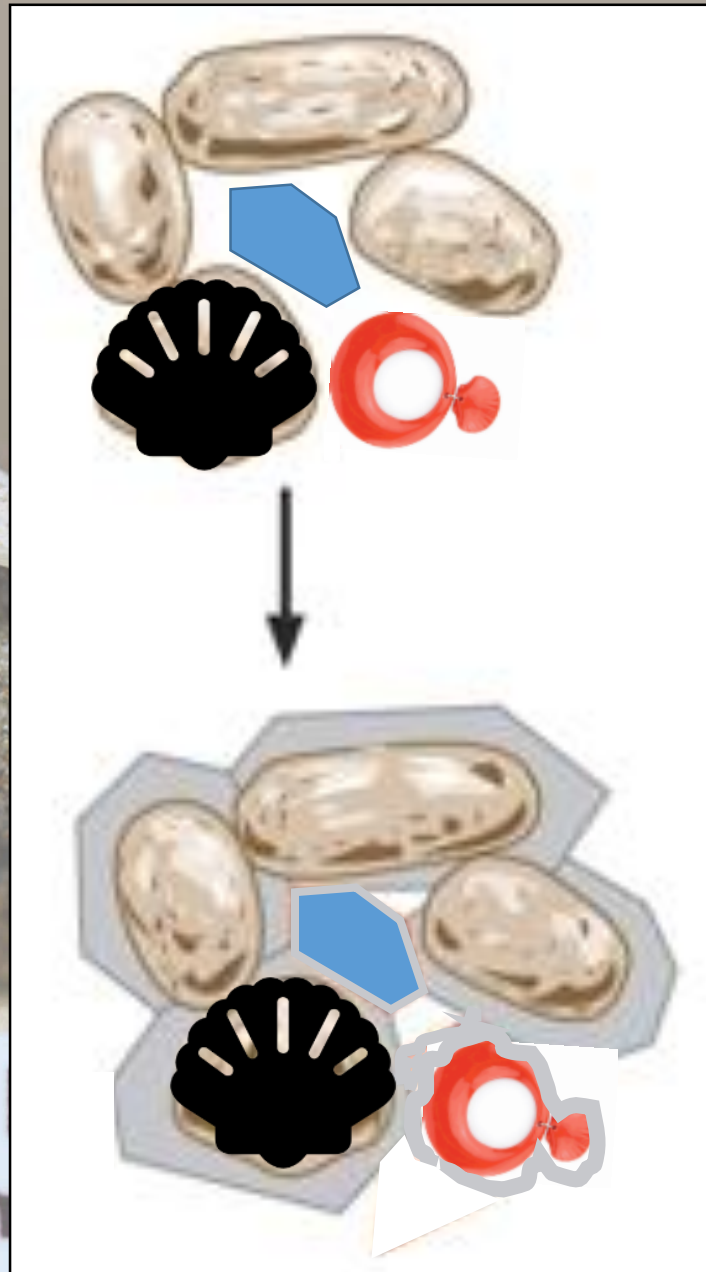
Amostras de coquina amostradas na praia do Hermenegildo, RS.

"Antroquinas são rochas que contém itens antropogênicos cimentados juntamente com material bioclástico e siliciclástico." (Fernandino et al., 2020)

Mas afinal, o que são antroquinas?



Mas afinal, o que são antropoquinas?



Mas afinal, o que são antropoquinas?

D



Modificado de Fernandino et al. (2020)

Mas afinal, o que são antropoquinas?

A



Modificado de Fernandino et al. (2020)



Mas afinal, o que são antropoquinas?



Modificado de Fernandino et al. (2020)

Mas afinal, o que são antropoquinas?

E



F



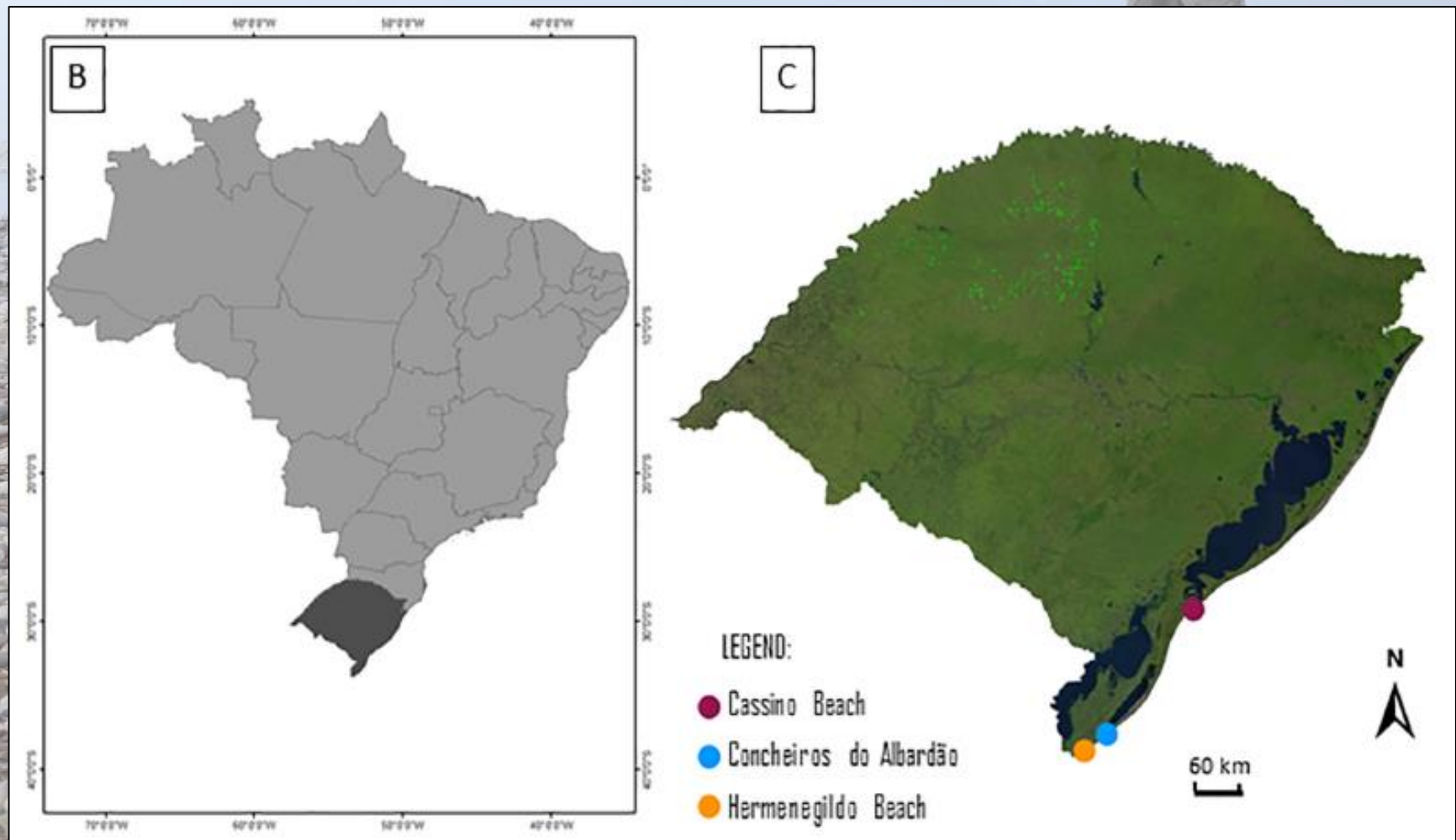
Modificado de Fernandino et al. (2020)

Mas afinal, o que são antropoquinas?

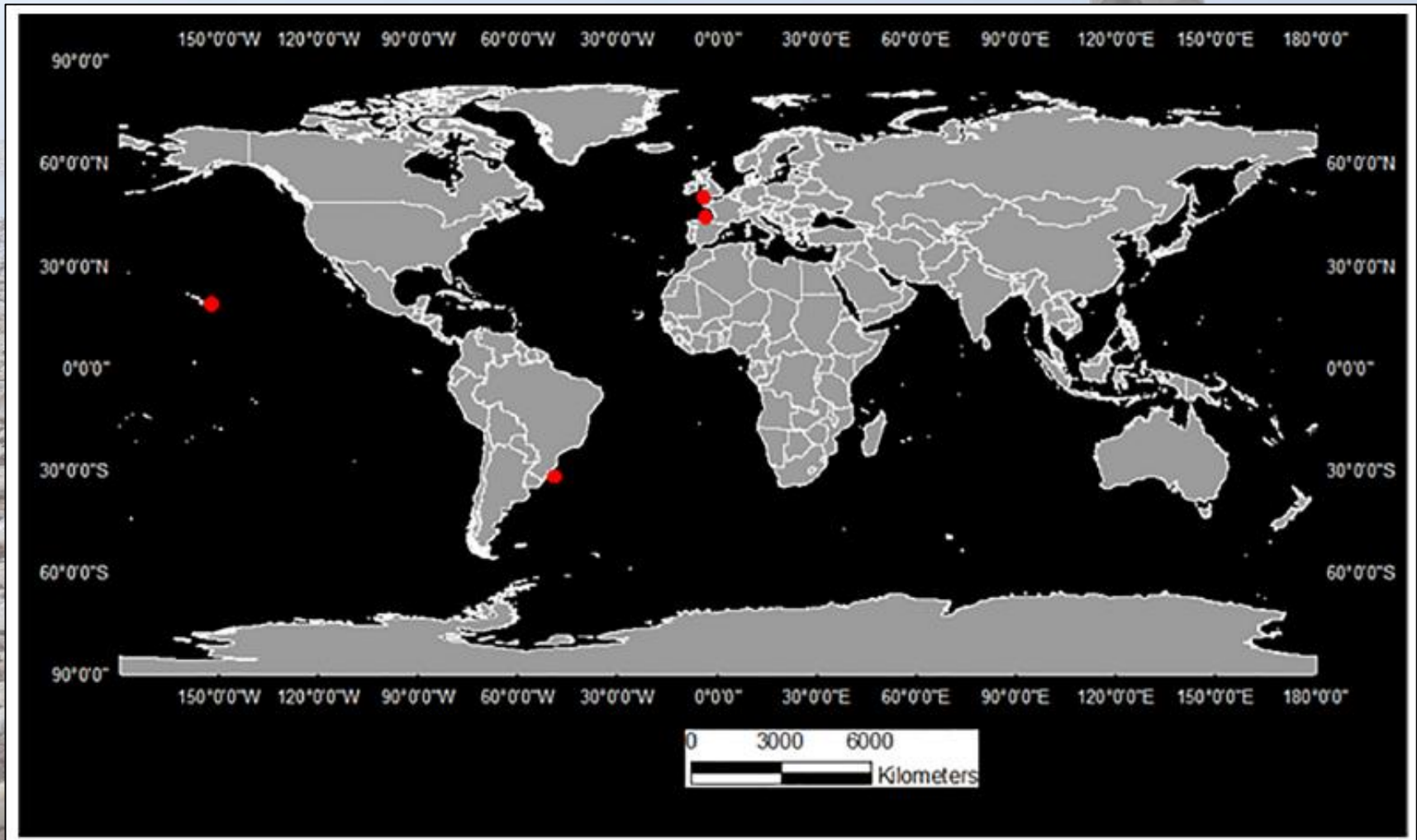


Modificado de Fernandino et al. (2020)

Onde encontramos as antropoquinas?



Onde encontramos as antropoquinas?



Como as antropoquinas foram encontradas?



Exemplos de detritos na praia do Hermenegildo, RS. (2018)

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Como as antropoquinas foram encontradas?



Antropoquinas – o que encontramos?

Table 1
Elemental composition (%) of samples 03 and 06 (S3 and S6) resulting from the EDS analysis of four points (in parenthesis).

Sample	C	O	Na	Mg	Al	Si	S	Cl	Ca	Mn	Fe
S6 (1)	2.37	66.29	1.44	0.50	0.52	2.29	3.58	1.92	1.95	0.85	18.28
S6 (2)	0.89	71.55	1.87	0.76	0.49	1.21	2.83	1.84	0.63	–	17.93
S6 (3)	1.55	65.75	1.82	0.73	–	0.59	2.39	2.74	0.64	1.37	22.43
S6 (4)	2.25	72.18	1.71	0.55	0.68	7.35	1.52	1.73	0.55	0.57	10.89
S3 (1)	23.46	63.54	–	1.38	1.31	4.88	0.38	–	2.56	–	2.47
S3 (2)	10.13	70.60	–	1.86	1.20	6.45	1.24	0.55	5.02	–	–
S3 (3)	20.29	63.27	–	1.56	1.17	9.89	–	–	3.82	–	–
S3 (4)	7.28	64.87	0.41	2.09	0.68	4.81	0.81	0.49	15.35	1.01	2.19

*EDS = *Energy Dispersive X-ray Spectroscopy*

Amostra 06 (S6)



Alto: **Ferro e Enxofre**
Baixo: **Carbono, Cálcio e Magnésio**

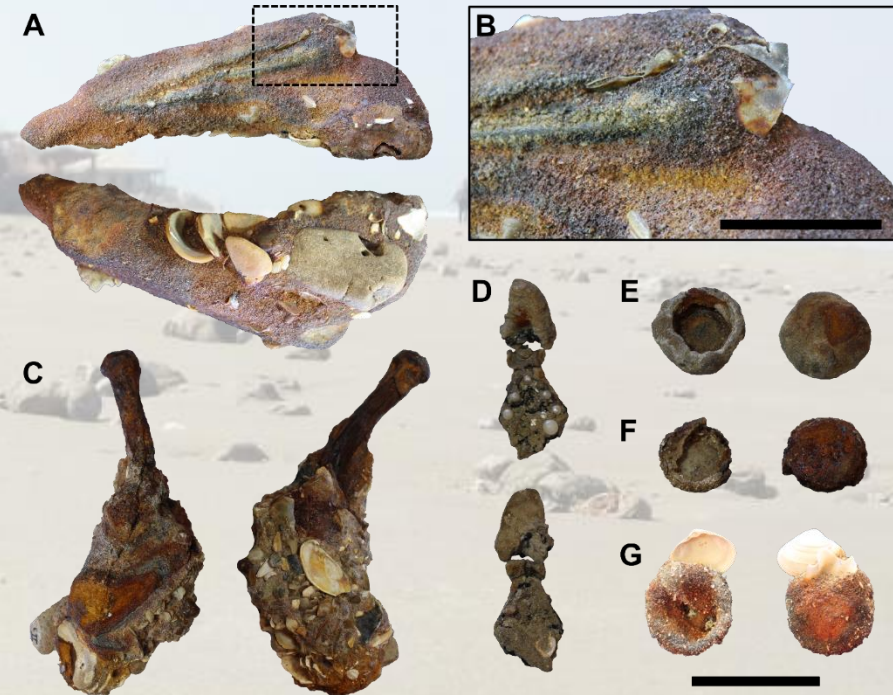
Amostra 03 (S3)



Alto: **Carbono, Cálcio e Magnésio**
Baixo: **Ferro e Enxofre**

Considerações finais

Possibilidade de existir
antropoquinas em outros
locais do **Brasil** e do **mundo**



Discussão no âmbito do **Antropoceno**

Objetivos do projeto:

- Interpretar a **gênese**
- Mapear a **distribuição** de antropoquinas no RS
- Descrever a **estrutura** e **composição**, separando e identificando o arcabouço e o cimento
- **Datação** (cimento)
- Análise **petrográfica**
- Macro, meso e microlixo no **sedimento**

Antropoquinas: o que o lixo no mar tem a ver com as geociências?

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