# Exploring Bioactive Compounds: Unveiling the Hidden Treasures of Bacterial Isolates from Algarve Coast Undersea Caves


UNIVERSIDADE DE ÉVORA

LABORATORIO HERCULES
HERANÇA CULTURAL, ESTUDOS E SALVAGUARDA

IN2PAST
PATRIMÓNIO | ARTE | SUSTENTABILIDADE | TERRITÓRIO

Sustainable Heritage
City University of Macau Chair

**Cátia Salvador**[1]

Patrícia Gatinho[1,2]

Silvia Arantes[1]

M. Rosário Martins[1,3]

A.Teresa Caldeira[1,4]

[1] HERCULES Laboratory – Cultural Heritage Studies and Safeguard & IN2PAST Associate Laboratory for Research and Innovation in Heritage, Arts, Sustainability and Territory, University of Évora, Évora, Portugal.

[2] Department of Engineer, School of Science and Technology, University of Trás-os-Montes e Alto Douro, Vila Real, Portugal.

[3] Department of Medical and Health Sciences, School of Health and Human Development, University of Évora, Évora, Portugal.

[4] Chemistry and Biochemistry Department, School of Sciences and Technology & City U Macau Chair in Sustainable Heritage & Sino-Portugal Joint Laboratory of Cultural Heritage Conservation Science, University of Évora, Évora, Portugal.


## Background

Microorganisms thriving in unique hypogenic environments, such as undersea caves, present a promising frontier for bioactive compounds discovery. These environments constitute ecosystems that provide an unparalleled canvas for the evolution of a wide range of microorganisms, resulting in unexplored biodiversity wealth. Within these cryptic realms, microorganisms have adapted to oligotrophic conditions by weaving complex metabolic networks, thus unlocking an untapped treasure trove of novel bioactive compounds. The quest for undiscovered microorganisms is driven by the significant potential to harness these biocompounds produced through their secondary metabolism, which can exhibit various biological functions, including antioxidant and antitumor activities [1].

Cancer remains among the top leading causes of death worldwide. Given this global challenge, there is an urgent need to discover innovative drugs that are more effective and have fewer side effects. Exploring the bioactive compounds produced by hypogean microorganisms may hold the key to developing groundbreaking pharmaceuticals.

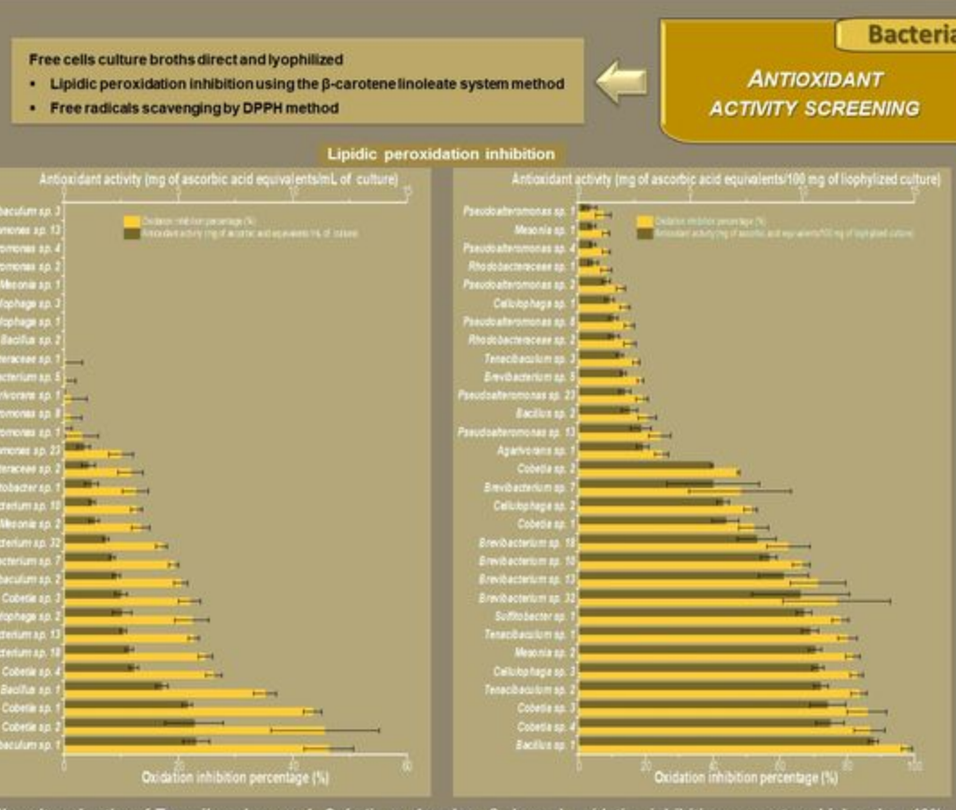
This study aims to prospect for new bioactive compounds produced by bacterial cultures, isolated from undersea caves (Sagres, Algarve-Portugal) [3] with an emphasis on assessing their antioxidant and antitumor potential [2].

Culturing bacteria from these hipogenic environments is useful for prospect about new sustainable biotechnological solutions and also represents an opportunity to preserve and value these Natural, Genetics and Cultural Heritages.

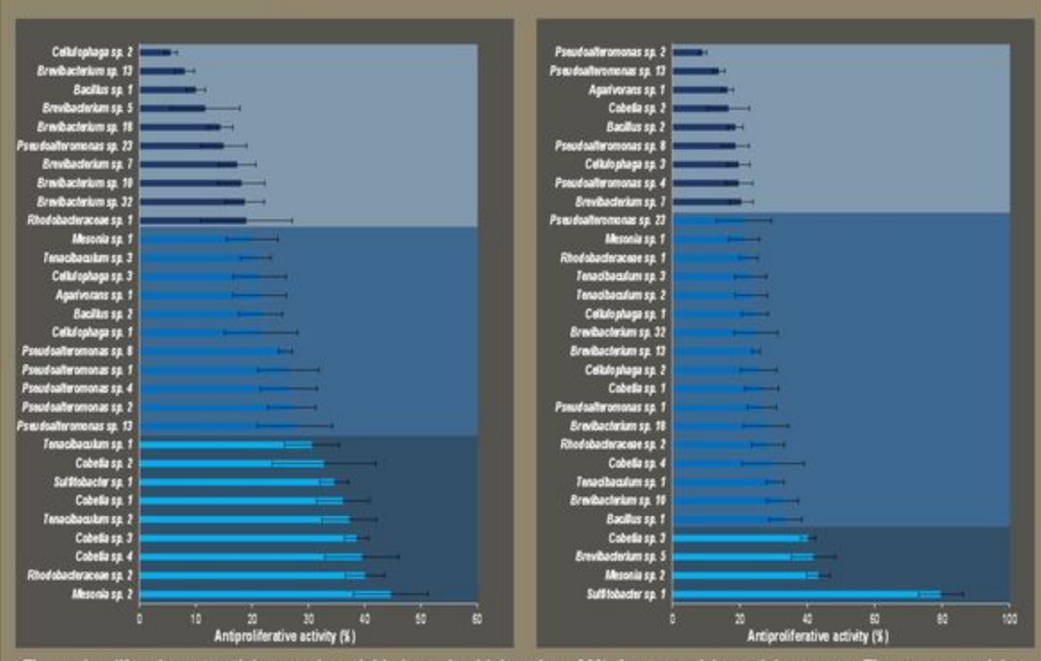
## Sampling & Bacterial Isolates



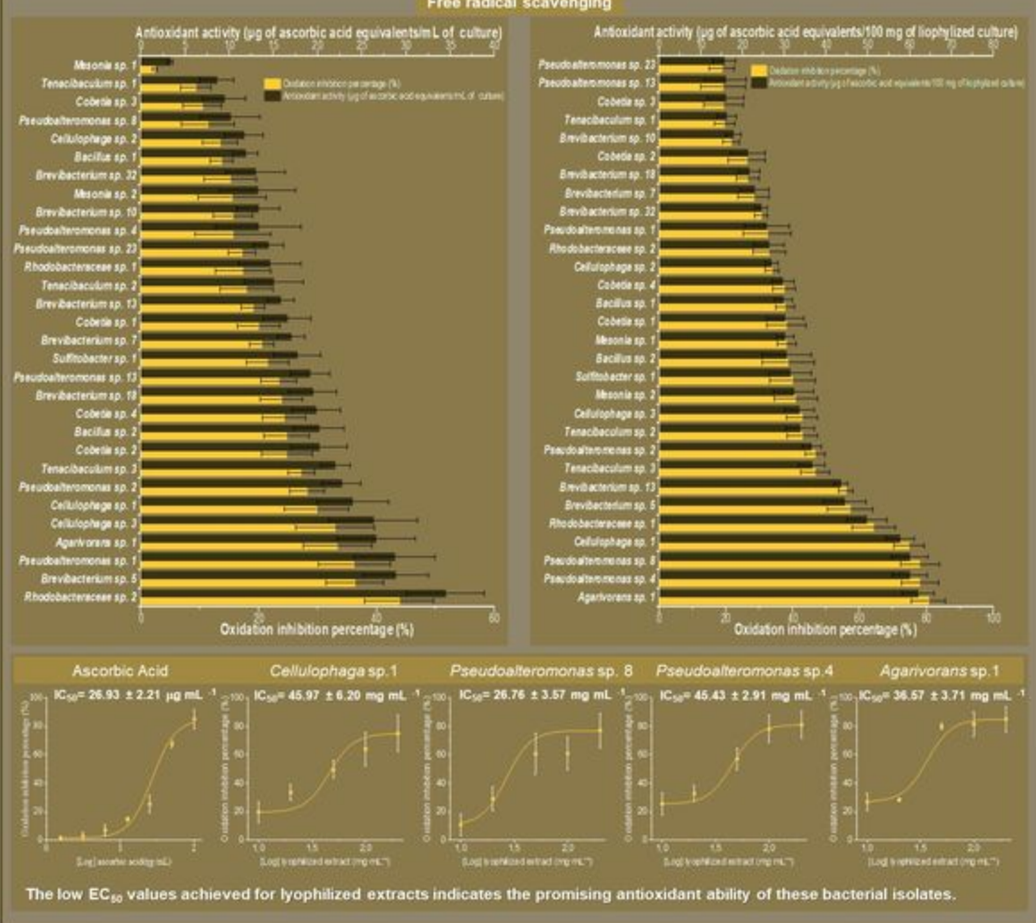
## Methodology and Results



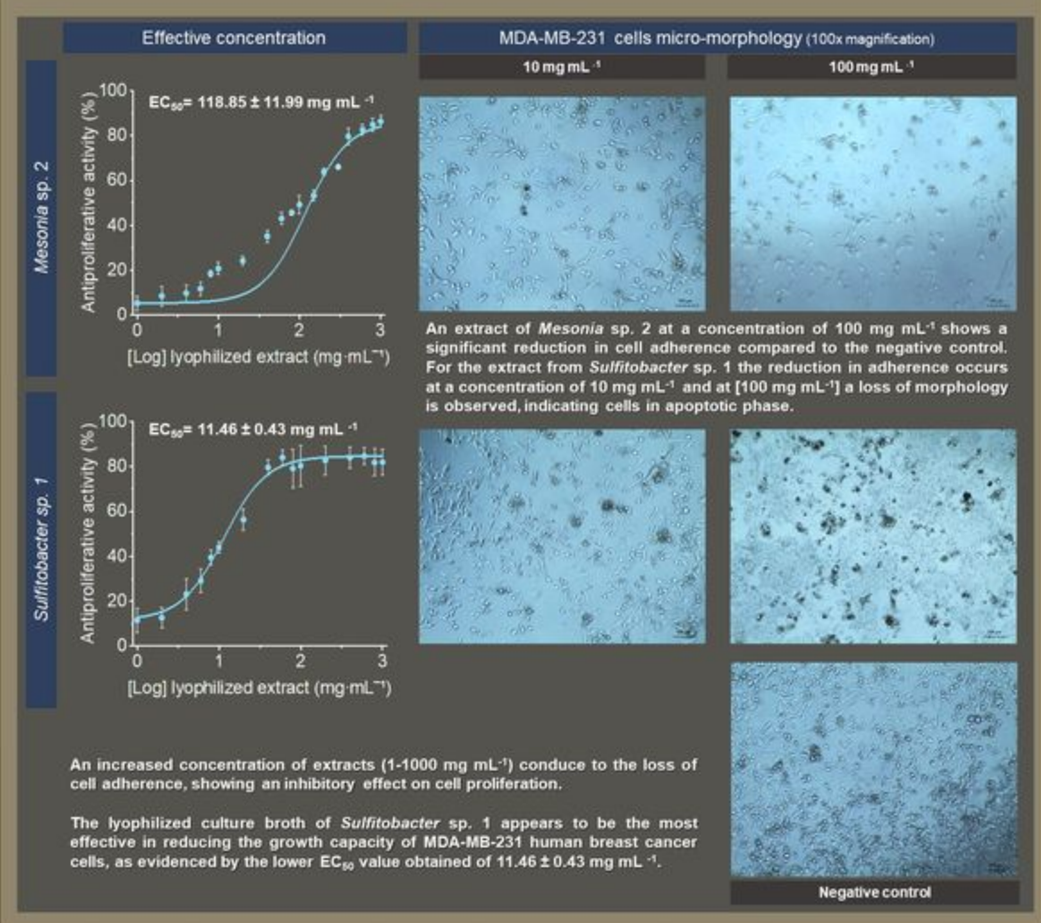

Free cells culture broths of *Tenacibaculum* sp. 1, *Cobetia* sp. 1 and sp. 2 showed oxidation inhibition percentage higher than 40%. Several lyophilized extracts at a concentration of 100 mg mL$^{-1}$ revealed increased oxidation inhibition percentage above 80%.




The antiproliferative potential screening yielded results higher than 30% for several bacterial extracts. The most promising isolates showed antiproliferative potential exceeding 40% when tested with 100 mg mL$^{-1}$ of lyophilized culture broth.




The low $EC_{50}$ values achieved for lyophilized extracts indicates the promising antioxidant ability of these bacterial isolates.




An extract of *Mesonia* sp. 2 at a concentration of 100 mg mL$^{-1}$ shows a significant reduction in cell adherence compared to the negative control. For the extract from *Sulfitobacter* sp. 1 the reduction in adherence occurs at a concentration of 10 mg mL$^{-1}$ and at [100 mg mL$^{-1}$] a loss of morphology is observed, indicating cells in apoptotic phase.

An increased concentration of extracts (1-1000 mg mL$^{-1}$) conduce to the loss of cell adherence, showing an inhibitory effect on cell proliferation.

The lyophilized culture broth of *Sulfitobacter* sp. 1 appears to be the most effective in reducing the growth capacity of MDA-MB-231 human breast cancer cells, as evidenced by the lower $EC_{50}$ value obtained of 11.46 ± 0.43 mg mL$^{-1}$.

## Remarks

- ✓ Cultures of bacterial isolates from undersea caves showed important antioxidant properties, revealing antioxidant activity by radical DPPH method and β-carotene linoleate system.
- ✓ Several supernatants from the bacterial cultures showed high anti-proliferative activity against MDA-MB-231 tumoral cell line highlighting the *Sulfitobacter* sp. 1 and *Mesonia* sp. 2.
- ✓ Our results are promising in the quest for new bioactive compounds from bacterial isolates found in undersea caves, creating potential for sustainable solutions with broader medicinal applications.


## Keywords

Marine Caves
Bacteria
Bioactive Compounds
Antioxidant Properties
Anti-tumoral Potential
Sustainable Products


## References


[1] Gatinho P., Salvador C., Silva A.M., Caldeira A.T. (2023). Prokaryotic Communities from Pristine Cave Environments: Biotechnological Potential with Sustainable Production. Sustainability, 15, 7471. https://doi.org/10.3390/su15097471

[2] Arantes S.M., Piçarra A., Guerreiro M., Salvador C., Candeias F., Caldeira A.T., Martins M.R., (2019). Toxicological and pharmacological properties of essential oils of Calamintha nepeta, Origanum virens and Thymus mastichina of Alentejo (Portugal). Food Chem Toxicol, 133, 110747. https:// doi: 10.1016/j.fct.2019.110747

[3] Salvador C., Arantes S.M., Martins M.R., Candeias A., Saiz-Jimenez C., Caldeira A.T. (2023). Microbial communities of underwater caves from Algarve coast: Biological activities prospection. TECHNART2023 Book of Abstracts, Nova School of Science and Technology of Lisbon, May 7-12, Lisbon, Portugal.
ISBN: 978-989-9164-08-6


## Contacts


Cátia Salvador: cscs@uevora.pt
Patrícia Gatinho: patricia.gatinho@uevora.pt
Silvia Arantes: saa@uevora.pt
M. Rosário Martins: mrm@uevora.pt
Ana Teresa Caldeira: atc@uevora.pt


## Funding & Acknowledgments


The authors acknowledge the FCT- Portuguese Foundation for Science and Technology - IP for funding within the scope of the projects: UIDB/04449/2020 (HERCULES Lab), IN2PAST (LA/P/0132/2020), ART3*mis* (DOI:10.54499/2022.07303.PTDC), MICROCENO (PTDC/CTA-AMB/0608/2020), C. Salvador individual support (DL572016/CP1372/CT0019).

The authors are grateful for the bacterial isolates from undersea caves obtained within the scope of the European Union's Project 0483_PROBIOMA_5_E, co-financed by the European Regional Development Fund within the framework of the INTERREG V-A Spain-Portugal program (POCTEP) 2014–2020.


MICROBIOTEC 23
CONGRESS OF MICROBIOLOGY AND BIOTECHNOLOGY 2023
December 7th - 9th | 2023
UBI, Covilhã