

APPLICATION FOR CONSENT TO CONDUCT MARINE SCIENTIFIC RESEARCH
IN AREAS UNDER NATIONAL JURISDICTION OF
ICELAND

Date: 23/01/2026

1 - GENERAL INFORMATION

1.1. Cruise name and/or number:

MORIA (Mediterranean Outflow Reach and Impact into the north Atlantic: present and past variability using neodymium isotopes)

1.2. Sponsoring institution:

Universitat de Barcelona

Gran Via de les Corts Catalanes 585

08007 Barcelona

1.3. Scientist in charge of the project:

Prof. Leopoldo David Pena González

Dept. de Dinàmica de la Terra i de l'Oceà

Facultat de Ciències de la Terra, Universitat de Barcelona

C/ Martí Franquès s/n, 08028 Barcelona

Phone: +34 934021596

Email: lpena@ub.edu

1.4. Scientist from Iceland involved in the planning of the project:

There are not Icelandic scientists directly involved in the planning of the project MORIA.

1.5. Submitting officer:

Prof. Leopoldo David Pena González

Dept. de Dinàmica de la Terra i de l'Oceà

Facultat de Ciències de la Terra, Universitat de Barcelona

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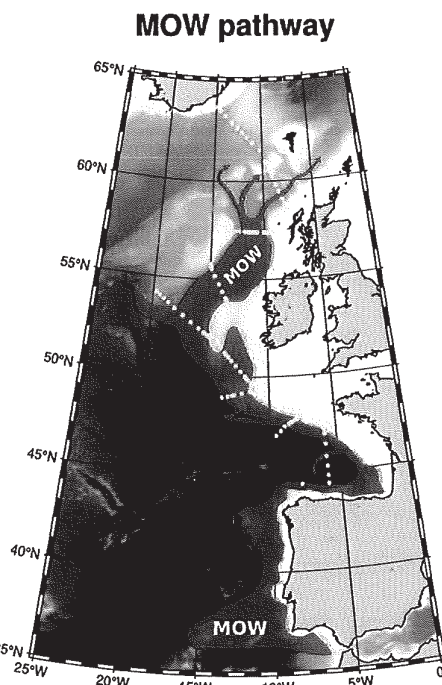
Email: lpena@ub.edu

2 - DESCRIPTION OF THE PROJECT

2.1. Nature and objectives of the project:

The **primary objective** of the campaign is the sampling of Mediterranean waters (Mediterranean Outflow Water and other adjacent water masses) that are exported along the Cantabrian margin toward the North Atlantic (Iceland). This will be one of the first European campaigns exclusively dedicated to the large-scale physico-chemical characterization of Mediterranean waters in the Northeast Atlantic, using state-of-the-art geochemical tracers (Nd isotopes, rare earth elements) that have never before been used for this purpose.

The **secondary objective** is the sampling of surface marine sediments along the transect using the innovative Monocorer system, which optimizes cruise time by recovering sediment during the same operation as the CTD. This sampling will be complemented with other sediment sampling systems such as multi-corer, box-corer, and gravity-corer. The ultimate goal is to chemically characterize and quantify the export rates of Mediterranean waters to the Northeast Atlantic and to attempt to address a controversial question within the scientific community: **Is the global thermohaline circulation controlled, to a greater or lesser extent, by the export of salts from the Mediterranean to the Northeast Atlantic?** In addition, the campaign also aims to study the transfer of this geochemical signal into the sedimentary record in order to investigate changes in Mediterranean water export in the past at different time scales.



Tasks to Be Performed Onboard the Vessel:

- Intensive CTD sampling and water collection using a rosette sampler along the path of the MOW, beginning work at the Cantabrian margin and continuing along the European continental margin up to Iceland. The sampling design includes transects perpendicular to the coast, crossing the core of these waters for their three-dimensional characterization (see map).
- Pre-processing of water samples in the ship's laboratory. *In situ* measurements of chemical parameters (oxygen, alkalinity, pH). Preservation of subsamples for laboratory analysis on land (nutrients, stable isotopes, rare earth elements, etc.).
- Collection of surface sediments at CTD stations using the Monocorer system.
- Targeted sampling of surface sediments (multi-corer, box-corer) or longer sediment records (gravity corer) at specific transect stations.

2.2. Relevant previous or future research cruises:

The project MORIA had a cruise planned in Sept-Oct 2025 within Icelandic territorial waters with permission granted on September 11th 2025 (see attached). However, due to extremely unfavorable weather conditions, none of the work initially planned was carried out within Icelandic waters in 2025. For this reason, in June 2026 the cruise MORIA 2 will try to complete the work initially planned. Therefore we request again the permits to conduct work in this area with the identical work plan that was previously approved by Icelandic authorities.

2.3. Previously published research data relating to the project:

- Basak, C., Y. Wu, B.A. Haley, J. Muratli, **L.D. Pena**, L. Bolge, J.N. Fitzsimmons, R.M. Sherrell, & S.L. Goldstein. (2024) Suspended Particulate Matter Influence on Dissolved Nd Concentration and Isotopic Composition along GEOTRACES Section GP16. Earth and Planetary Science Letters 635: 118692.
- Trias-Navarro, S., **Pena, L.D.**, de la Fuente, M., Paredes, E., Garcia-Solsona, E., Frigola, J., Català, A., Caruso, A., Lirer, F., Haghipour, N., Pérez-Asensio, J.N., Cacho, I. (2023). Changes in the eastern Mediterranean water outflow since the last deglaciation. Communications Earth & Environment, 4 (1), 175.
- Wu, Y., **Pena, L.D.**, Anderson, R.F., Hartman, A.E., Bolge, L.L., Basak, C., Kim, J., Rijkenberg, M.J.A., De Baar, H.J.W. & Goldstein, S.L. (2022) Assessing neodymium isotopes as an ocean circulation tracer in the Southwest Atlantic. Earth and Planetary Science Letters, 599, 117846.
- Haley, B.A., Wu, Y., Muratli, J.M., Basak, C., **Pena, L.D.** & Goldstein, S.L. (2022). Rare earth element and neodymium isotopes of the eastern US GEOTRACES Equatorial Pacific Zonal Transect (GP16). Earth and Planetary Science Letters, 576, 117233.
- García-Solsona, E., **Pena, L.D.**, Paredes, E., Pérez-Asensio, J.N., Quirós-Collazos, L., Lirer, F. And Cacho, I., 2020. Rare Earth Elements and Nd isotopes as tracers of modern ocean circulation in the central Mediterranean Sea. Progress in oceanography 185: 102340.

3 - METHODS AND MEANS TO BE USED

3.1. Particular of vessel:

Name RV Odón de Buen

Nationality Spanish

Owner CSIC (Consejo Superior de Investigaciones Científicas) / Instituto Español de Oceanografía (IEO-CSIC)

Operator	CSIC / IEO-CSIC
Type of vessel	Oceanographic Research Vessel
Year built and country	2024, Spain (Astilleros Armon, Vigo)
Length / width	84.30 m / 17.80 m
Length p.p.	77.40 m
Design Draught	6.54 m
Scantling Draught	5.2–5.5 m (operational draught)
Depth to main deck	5.60 m
Tonnage (Gross)	4,595 GT
Dead weight (DWT)	~10,700 t
Maximum Speed	14.5 knots
Prop. Power	2 × INDAR 1700 kW electric motors
Fuel	Diesel + LNG dual-fuel generators
Endurance	40 days (diesel), 10 days (LNG)
Accommodation (crew + research)	58 (20 crew + 38 scientists/technicians)
Classification society	Lloyd's Register, notation: 100A1 Oceanographic & Fishing Research, Ice Class PC7
IMO	9962914
Register port	Vigo, Spain (home port)
Call code	EABT
VSAT	+34911930378
Cellular	+34 610583701
Email	capitan.odb@utm.csic.es
Name of master	Adrian Gerpe Olivera Alejandro Marín Portillo
Number of crew	20

Number of scientists on board 38

3.2. Aircraft or other craft to be used in the project:

No additional crafts or oceanographic vessels will be used for this cruise.

3.3. Particulars of methods and scientific instruments:

<i>Provide a list of the main scientific equipment that is going to be used, saying the waters where it will be used / installed</i>	<i>Fisheries research within the established fishing limits</i>	<i>Research related to the continental shelf beyond the limits of the coastal state</i>	Distance to shore		
			<i>Within 12 nautical miles</i>	<i>Within 12 and 50 nautical miles</i>	<i>Within 50 and 200 nautical miles</i>
Multiparameter profiler CTD Sea-Bird 911 plus with hydrographic rosette o 24 Niskin bottles (12L) for water collection. Sensors of conductivity, temperature, pressure, oxygen, fluorometer, turbidity/transmisometer and altimeter.	NO	NO	NO	YES	YES
NIOZ Monocorer for surface sediment collection	NO	NO	NO	YES	YES
Gravity corer (up to 5m length) for sediment collection	NO	NO	NO	NO	YES
Multicorer KC Iceland for surface sediment collection	NO	NO	NO	NO	YES
Boxcorer sampler for surface sediment collection	NO	NO	NO	NO	YES

3.4. Indicates whether harmful substances will be used:

No toxic or harmful substances will be used or released during the cruise.

3.5. Indicate whether drilling will be carried out:

It is planned to use surface sediment sampling systems such as Monocorer, Multicorer and Box corer as well as the collection of sediment sections between 1-4 meters of length using a Gravity corer system.

3.6. Indicate whether explosives will be used:

No explosives will be used during the cruise

4 - INSTALLATIONS AND EQUIPMENTS

Details of installations and equipments (dates of laying, servicing, recovery, exact locations and depth):

The sampling equipments that will be used are the same mentioned in section 3.3 in this document. There is no plan to deploy any additional equipment and all the water and sediment sampling will be carried out "in situ". No permanent/temporary equipment will be installed or deployed for later recovery.

Sampling Description

Seawater sampling will be carried out using a hydrographic rosette equipped with 12L Niskin bottles and a full multiparameter CTD profiler (Sea-Bird 911 Plus). Water sampling will take place onboard the research vessel.

Surface sediment sampling will be conducted using a NIOZ Monocorer system (KC Iceland) or a box corer, depending on weather conditions and the type of surface sediment in each working area. At some stations, depending on weather conditions and type of surface sediment some sediment cores of up to 4 meters in length may be recovered using a Gravity Corer.

Planned station list

The following table includes all the stations planned during the **MORIA** cruise. Stations planned in Icelanders jurisdictional waters are highlighted, indicating geographical coordinates and water depth.

Station	Lon (°)	Lat (°)	Water depth (m)	Territorial waters
Rinse	-7.769	44.447	-4891	Spain
1	-5.869	44.405	-4762	Spain
2	-5.866	44.805	-4806	Spain
3	-5.866	45.277	-4773	Spain
4	-5.866	45.779	-4704	France
5	-5.864	46.414	-4392	France
6	-5.861	46.952	-2156	France
7	-5.863	47.151	-2002	France
8	-5.864	47.167	-1509	France
9	-5.864	47.199	-1013	France
10	-5.863	47.218	-490	France
11	-5.864	47.262	-169	France
12	-7.608	47.91	-266	France
13	-7.894	47.8	-530	France
14	-8.1	47.724	-1003	France
15	-8.326	47.636	-1504	France
16	-8.522	47.56	-1997	France
17	-8.871	47.423	-3526	France
18	-9.196	47.2	-4504	France
19	-9.555	46.958	-4350	France
20	-13.731	48.944	-4508	International waters
21	-13.256	49.015	-3635	Ireland
22	-12.886	49.068	-2007	Ireland
23	-12.734	49.091	-1491	Ireland
24	-12.144	49.17	-997	Ireland
25	-11.461	49.265	-493	Ireland
26	-11.073	49.327	-184	Ireland
27	-11.199	49.537	-253	Ireland
28	-11.369	49.666	-490	Ireland
29	-11.629	49.85	-1002	Ireland
30	-11.768	49.96	-1509	Ireland
31	-11.889	50.049	-2000	Ireland
32	-12.228	50.292	-2286	Ireland
33	-12.634	50.591	-2349	Ireland
34	-12.991	50.851	-2194	Ireland
35	-13.235	51.035	-1982	Ireland
36	-13.419	51.166	-1501	Ireland
37	-13.543	51.26	-997	Ireland
38	-13.897	51.526	-500	Ireland
39	-14.269	51.798	-365	Ireland
40	-14.843	52.044	-503	Ireland
41	-14.914	52.078	-1040	Ireland
42	-15.029	52.128	-1443	Ireland
43	-15.268	52.238	-1486	Ireland
44	-15.373	52.275	-2044	Ireland
45	-15.79	52.469	-3266	Ireland
46	-16.491	52.773	-3511	International waters
47	-17.221	53.099	-3413	International waters
48	-17.984	53.44	-2559	International waters
49	-18.625	53.703	-2443	International waters
50	-19.024	53.891	-2072	International waters

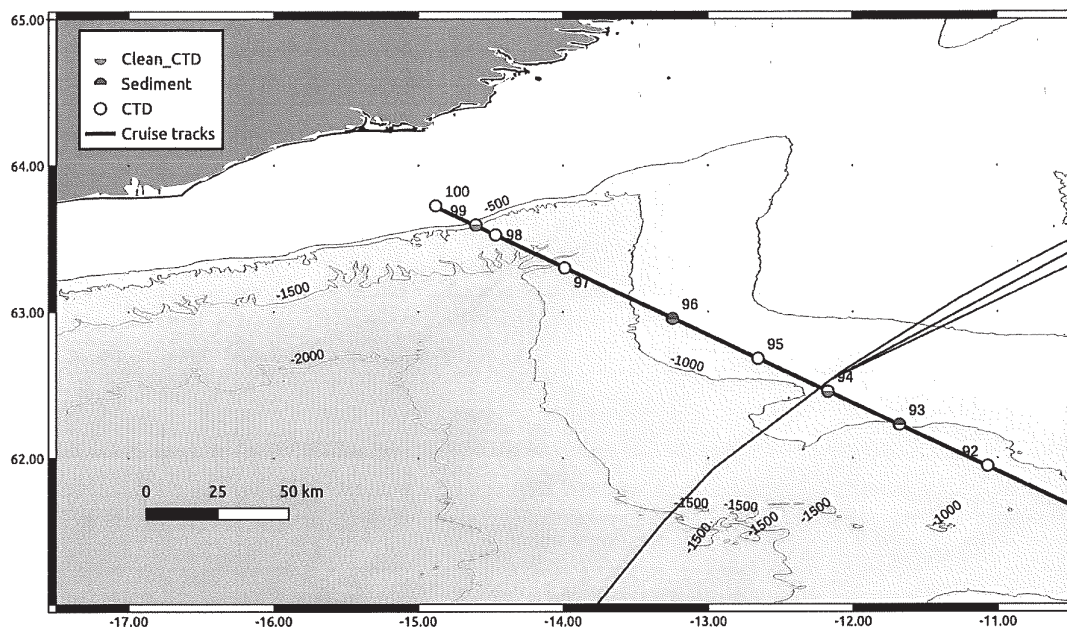
Station	Lon (°)	Lat (°)	Water depth (m)	Territorial waters
51	-19.417	54.059	-1505	International waters
52	-19.73	54.201	-1287	International waters
53	-15.528	56.261	-283	International waters
54	-15.103	55.794	-492	Ireland
55	-15.024	55.7	-1018	Ireland
56	-14.961	55.632	-1588	Ireland
57	-14.882	55.537	-2033	Ireland
58	-14.552	55.185	-2501	Ireland
59	-14.168	54.771	-2756	Ireland
60	-13.848	54.393	-2896	Ireland
61	-13.557	54.078	-1986	Ireland
62	-13.51	54.025	-1472	Ireland
63	-13.452	53.96	-958	Ireland
64	-13.397	53.899	-442	Ireland
65	-13.276	53.752	-309	Ireland
66	-13.481	57.498	-164	Great Britain
67	-12.956	57.49	-469	Great Britain
68	-12.856	57.484	-1021	Great Britain
69	-12.746	57.482	-1492	Great Britain
70	-12.323	57.474	-1792	Great Britain
71	-11.809	57.458	-1809	Great Britain
72	-11.51	57.45	-2004	Great Britain
73	-11.4	57.445	-1446	Great Britain
74	-11.085	57.44	-585	Great Britain
75	-10.72	57.432	-1033	Great Britain
76	-10.656	57.429	-2008	Great Britain
77	-10.013	57.411	-2011	Great Britain
78	-9.724	57.403	-1480	Great Britain
79	-9.595	57.403	-978	Great Britain
80	-9.477	57.4	-448	Great Britain
81	-9.188	57.387	-149	Great Britain
82	-7.689	58.589	-134	Great Britain
83	-7.864	58.791	-494	Great Britain
84	-7.929	58.862	-985	Great Britain
85	-8.124	59.083	-1435	Great Britain
86	-8.463	59.478	-1355	Great Britain
87	-8.741	59.798	-1297	Great Britain
88	-9.108	60.244	-1453	Denmark
89	-9.402	60.569	-409	Denmark
90	-9.754	60.979	-986	Denmark
91	-10.268	61.567	-1254	Denmark
92	-11.069	61.946	-1044	Denmark
93	-11.678	62.229	-1001	Denmark
94	-12.171	62.455	-943	Denmark
95	-12.654	62.681	-833	Iceland
96	-13.247	62.954	-820	Iceland
97	-13.987	63.3	-1375	Iceland
98	-14.465	63.526	-1301	Iceland
99	-14.601	63.594	-865	Iceland
100	-14.88	63.725	-198	Iceland

5 - GEOGRAPHICAL AREAS

5.1. Indicate geographical areas in which the project is to be conducted (with reference in latitude and longitude):

The MORIA cruise presents a very wide working area, covering most of the North East European margins. The cruise will be conducted between 44.40°N – 63.72°N in latitude and -5.00°W – -19.73°W in longitude. The sampling corresponding to Icelanders jurisdictional waters will take place between the following coordinates: 62.50° – 63.75°N in latitude and -12.50° – -15.00°W in longitude.

5.2. Attach chart(s) at an appropriate scale showing the geographical areas of the intended work and, as far as practicable, the positions of intended stations, the tracks of survey lines, and the locations of specific equipments or facilities:



6 - DATES

6.1 Expected dates of first entry into and final departure from the research area of the research vessel:

entry date : 20/06/2026

departure date : 29/06/2026

6.2 Indicate if multiple entry is expected:

No re-entry is expected.

7 - PORTS CALLS

7.1. Dates and names of intended ports of call in Iceland:

No port calls are scheduled in Iceland

7.2. Any special logistical requirements at ports of call:

None

7.3. Name/Address/Telephone of shipping agent (if available):

None

8 - PARTICIPATION

8.1. Proposed dates and ports for embarkation/disembarkation:

start	date : 14/06/2026	Vigo (Spain)
end	date : 29/06/2026	Reykjavik (Iceland)

9 - ACCESS TO DATA, SAMPLES AND RESEARCH RESULTS

9.1. Expected dates of submission of preliminary reports which should include the expected dates of submission of the final results:

Scientific cruise report will be submitted to the corresponding Icelanders authorities within 1-2 months after cruise completion.

9.2. Proposed means for access by the Icelanders scientific and public entities, to data and samples:

The results obtained during the cruise and during the lifespan of the project will be shared with Icelanders researchers (see section 1.4 in this document) through scientific collaborations and sample exchanges in order to study the materials recovered during the cruise.

9.3. Proposed means of making research internationally available:

The MORIA cruise has been officially endorsed as an international **GEOTRACES process study**. The international GEOTRACES program is a landmark in geochemical research across all the oceans involving many different nations. The acceptance as a GEOTRACES process study not only provides a "high quality seal" to the research proposed but also guarantees that all the data produced will be available in open repositories for the international scientific community. The GEOTRACES SSC has provided an official letter of support for this project. Different data repositories are considered (EMODNET, EarthChem, PANGAEA, etc) and all data will be progressively made available upon analysis of samples are completed back into the laboratories.

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ANNEX

List of the scientific team

Name	Institution	Role
Leopoldo D. Pena	Universitat de Barcelona	Chief Scientist
Jaime Frigola	Universitat de Barcelona	Co-chief Scientist
Galderic Lastras	Universitat de Barcelona	Researcher
Eva Calvo	ICM-CSIC	Researcher
Juan Santos Echeandía	IEO-CSIC	Researcher
Aridane González	Universidad Las Palmas Gran Canaria	Researcher
Marta Arjona	Universitat de Barcelona	Post-doc
Dimitris Evangelinos	Universitat de Barcelona	Post-doc
Judit Torner	Universitat de Barcelona	Post-doc
Albert Català	Universitat de Barcelona	Post-doc
Sara Espinosa	Universitat de Barcelona	PhD student
Sara Campderrós	Universitat de Barcelona	PhD student
Mar Selvaggi	Universitat de Barcelona	PhD student
Alejandra Sánchez	ICM-CSIC	PhD student
David González	Universidad Las Palmas Gran Canaria	PhD student
Adrià Tejero	Universitat de Barcelona	Technical staff
María Jesús Álvarez	IIM-CSIC	Technical staff

UTM technical staff: 3 CTD technicians, 2 mechanics/sediment technicians, 1 sound tech, 1 informatic, 1 ship-laboratory support tech and 1 deck hand technician.

Attached files: excel file with station list.