
**Marine environment impact
assessment (MEIA) — Specification for
marine sediments in seabed areas —
Survey of interstitial biota**

*Évaluation de l'impact environnemental marin — Spécifications
relatives aux sédiments marins dans les zones de fonds marins —
Étude du biote interstitiel*

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CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee 8, *Ships and marine technology*, Subcommittee SC 13, *Marine technology*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Interstitial biota in marine sediments refers to the benthic life forms inhabited or deposited in the interstitial spaces between sediment particles, including marine microorganisms, benthic virus, microbenthos and meiobenthos. They cover the six “kingdoms” of life in the three-domain taxonomic system: Archaea, Bacteria, Fungi, Protista, Plantae and Animalia. Interstitial biota in marine sediments are so small that cannot be obtained and analysed by conventional methods for marine biological survey; they are numerous and complex; they have diverse functions, remarkable ecological significances and rich gene resources; they are ubiquitous and make up the basic components of the life system in marine sediments. Sediment interstitial biotas are the most abundant and complex life groups in the estuaries, intertidal zones, shelf shallow seas and deep sea. They play key roles in the regulation of material and energy flows in benthic ecosystems.

In seabed areas, a number of large international research programs have been carried out, such as the ocean drilling program (ODP) and the international ocean discovery program (IODP). Interstitial biota in marine sediments surveys have been key to solve scientific problems in relevant fields, such as marine biodiversity, oil and gas resource exploration, marine carbon cycle, global change, monsoon rainfall, ice melting, ocean acidification and deep-sea biological resources. But so far the lack of an International Standard leads different countries to use different regulations and technologies on the investigations, resulting in barriers to comparing research results in international cooperation.

This document provides relevant technical approaches for the investigation of sediment interstitial biota in seabed areas. Its purpose is to reflect the recent developments of modern marine science and technology to facilitate international cooperation. It is applicable to investigations and evaluations of marine sediment biodiversity in seabed areas, favouring the development and utilization of marine biological resources, the comprehensive environmental exploration, ecological environment assessment, protection and management, etc. The specifications in this document incorporate technical advances and technological key points reflecting current state-of-the-art and international practice.

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Marine environment impact assessment (MEIA) — Specification for marine sediments in seabed areas — Survey of interstitial biota

1 Scope

This document provides requirements and recommendations for conducting marine surveys of interstitial biota in marine sediments. It includes the specification of technical methods for the investigation of marine sediments, foraminifera, ostracoda, radiolaria, diatoms, coccoliths, sedimentary sporopollen, benthic viruses, benthic microbes (including bacteria, archaea and fungi), benthic microalgae, benthic protozoa and metazoan meiobenthos.

This document is applicable to marine surveys in diverse benthic habitats at any seabed, such as benthic sediments of coastal zones, shallow seas, or deep-sea waters.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

marine sediment

substances under the action of crustal surface geology, where the original products such as weathered rocks, metamorphic rocks and pre-existing *sedimentary rocks* (3.2) of the parent rocks (i.e. magmatic rocks, metamorphic rocks and sedimentary rocks) are transported, settled or precipitated by biogenic, volcanic and cosmic phenomena as loose unconsolidated deposits on the sea floor

3.2

sedimentary rock

one of the three major types of rocks that make up the lithosphere (the other two are magmatic rocks and metamorphic rocks), which are formed from the weathering products of a parent rock (or any pre-formed rock), biogenic materials, volcanic material, cosmic material and other original material, and sedimentation after the formation of rock diagenesis

3.3

interstitial biota

benthic life forms that inhabit or are deposited in the interstices between sediment particles

Note 1 to entry: It includes *marine microorganisms* (3.6), benthic viruses, *microbenthos* (3.4), and meiobenthic organisms. In terms of individual sizes, interstitial biota in *marine sediments* (3.1) cover femto-level with a size of less than 0,2 μm , pico-level (0,2 μm to 2 μm), nano-level (2 μm to 20 μm) and micro- and meio-level benthic organisms of more than 20 μm .

3.4 microbenthos

unicellular prokaryotic and eukaryotic microbes living on the surface, and within the interstices, of sediments, which can be trapped by 0,2 µm membrane filtration

Note 1 to entry: Mainly benthic bacteria, benthic microalgae and *benthic protozoa* (3.5). See [Figure A.1](#) for examples of major groups. In terms of sizes of individuals, the microbenthos covers the pico-level of less than 2 µm, the nano-level (2 µm to 20 µm) and the micro-level of more than 20 µm.

3.5 benthic protozoa

unicellular eukaryotes whose life history is entirely or mostly associated with sedimentary environments

Note 1 to entry: It includes heterotrophic flagellates, ciliates, amoebae, etc.

3.6 marine microorganism

microeukaryotes and metazoans included in sedimentary investigations and marine geological surveys, including extant and fossil species of various groups

Note 1 to entry: It includes foraminifera, ostracoda, radiolaria, diatoms, calcareous fossils, sporopollen, pteropoda, ichthyoliths, etc.

3.7 benthic microbe

unicellular and small acellular organism with simple structure and a variety of physiological types that inhabits sedimentary environments

Note 1 to entry: It includes bacteria, archaea and fungi.

3.8 metazoan meiobenthos

metazoan meiofauna

small metazoa and larvae of large metazoans living in sedimentary environments that can pass through a 500 µm aperture mesh but are retained on a 42 µm to 31 µm aperture mesh

Note 1 to entry: The main groups include nematodes, copepods, tardigrades, ostracods, gastrotrichs, priapulid worms, bivalves, arthropods, acarina, polychaetes, kinorhyncha, rotifers, etc. Several major groups are shown in [Figure A.2](#).

4 General

4.1 Technical design

Surveys of interstitial biota in sediments should be designed in terms of survey-related items, including survey section, station, object, detail, method, date, frequency, device, personnel quality, ship, equipment, expected results and survey plan. The establishment of the investigation plan shall refer to the requirements of the related survey plan.

4.2 Basic recommendations for the surveys

4.2.1 Survey object

The survey object can include marine sediments, foraminifera, ostracoda, radiolaria, sedimentary diatoms, coccoliths, sporopollen, benthic viruses, benthic microbes, benthic microalgae, benthic protozoa, and metazoan meiobenthos. Specific objects may be adjusted or designed according to the survey plan.

4.2.2 Auxiliary parameters

Auxiliary observation objects can be added, if necessary, to the survey. These can be designed on the basis of the survey plan.

4.2.3 Recommendations for the sampling equipment

The sampling equipment should follow the recommendations of related clauses in this document.

The common equipment for sediment sampling includes box-corers, multicorers, grab samplers, gravity samplers or drills. Deep-sea sampling equipment can also include remotely-operated vehicles (ROV) and manned submersibles. The main disadvantage of grab sampling is that it is not possible to preserve the seafloor surface sediments, and it rarely preserves depositional sequences.

4.2.4 Auxiliary equipment on board ship

The auxiliary equipment on board ship includes the following:

- a) winch systems: a winch system is required for the operation of general multicorers or box-corers; a winch system for armoured cable is required for the operation of television (TV) multicorers and TV box-corers;
- b) large A frames: the lifting height should be 4,5 m or more.

4.2.5 Sampling method and scope of application

4.2.5.1 Sediment sampling (standards.iteh.ai)

Sediment sampling can be used to survey marine sediments for foraminifera, ostracoda, radiolaria, sedimentary diatoms, coccoliths, sporopollen, benthic viruses, benthic microbes, benthic microalgae, benthic protozoa, and metazoan meiobenthos. Sampling should follow the recommendations of the related clauses in this document.

4.2.5.2 Trawl sampling

Trawling can be used for auxiliary sampling of planktonic foraminifera, ostracoda, radiolaria, protozoa, etc.

4.2.5.3 Water sampling

Water sampling can be used to survey planktonic foraminifera, living radiolaria, etc. Sampling shall satisfy the requirements of related clauses in this document.

4.3 Sampling

4.3.1 Sediment sampling

Sediments should be collected by the specified sampler. Staff should strictly abide by the operating procedures and pay attention to the condition of the sampler. Surface samples or core samples shall be collected, treated and stratified according to the requirements of the survey. Sediment sampling procedures in offshore and coastal areas should follow the recommendations in ISO 5667-19:2004, 5.1. Stratigraphic equipment for processing surface samples is shown in [Figures B.1](#) and [B.2](#). In abnormal situations, replicate samples should be collected.

4.3.2 Trawl sampling

Sampling nets can be used in trawl sampling. The speed of net deployment and net withdrawal should be strictly controlled, and the time of net arrival at the target should be determined accurately. The

condition of the net should be noted, and effective measures should be adopted if the situation is abnormal. The net should be washed, and the samples collected carefully, especially biological samples that can stick to the net and pipe.

4.3.3 Water sampling

Water can be collected using a water sampler. Before deployment, check that the cover is open and the faucet is closed. Deploy the water sampler to the target area and maintain its position for a precise time. Water sampling and sample treatments shall satisfy the requirements of related clauses in this document.

4.3.4 Records

All survey objects should be recorded according to the related clauses in this document. Examples of sample record tables are shown in [Annex C \(Tables C.1, C.2, C.3\)](#).

Take additional photos and videos in the case of abnormal phenomena or new discoveries.

4.4 Sample analysis

4.4.1 Sample treatment

Treat the samples according to the related clauses in this document.

4.4.2 Sample measurement

Measurement items should be determined according to the related clauses in this document.

4.4.3 Sample treatment and storage

Samples can be stratified, fixed and dyed on-site according to the related clauses in this document.

Preserve samples after analysis, measurement and identification, either complete or partial, according to the application and academic value. Samples storage should comply with the survey plan.

4.4.4 Sample identification and enumeration

Identify the organisms to the species level wherever possible, and enumerate according to the related requirements in this document. Observe and analyse the samples by microscopy, and record in a table similar to [Tables D.1, D.2, D.3, D.4](#).

4.4.5 Sample data analysis

Data to be analysed are mainly related to community structure, abundance, relative abundance, or dominant groups of interstitial biota in marine sediments. Data analysis can refer to the related clauses in this document.

Analyse data with statistical software. [Annex E](#) provides methods of calculation of the community parameters. [Table E.1](#) shows biomass conversion factors.

4.5 Basic recommendations of data organization

4.5.1 Organization of data

4.5.1.1 Quantification and statistics

Quantify and analyse the results of identification and enumeration using the formulas and formatting given in this document.

4.5.1.2 Fill in forms

Fill in the forms according to related provisions of this document.

4.5.1.3 Draw charts

Draw charts to show data according to the requirements of this document.

4.5.1.4 Voyage report

A voyage report, including related requests according to the survey plan, should be completed by the scientist responsible to the object after the survey.

4.5.2 Data archiving, acceptance and achievements appraisal

Data archiving, acceptance and appraisal of achievements should be carried out with related requests in this document.

4.6 Survey results

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4.6.1 Original records

Original records made during the survey, including those of sediment, sedimentary rock, organisms, and water samples, field descriptions, location records, etc. shall be retained. This is first-hand information and includes the primary results of the survey.

4.6.2 Maps or drawings

Draw maps or figures on a prescribed scale based on data analysis and calculation.

4.6.3 Investigation report

The investigation report should include the following.

- a) Preface, including the survey plan, survey area, content and workload of the objects, work time (indoor and outdoor).
- b) Survey and data consolidation, including working methods, station design, quality of original data, methods of data consolidation, accuracy of results.
- c) Results, including sediment types, suspension concentration, structure, abundance and distribution of main biota.
- d) Data analysis, including method and its basis, distribution characteristics and comprehensive analysis of every element.
- e) Conclusions, including suggestions for further work.