

British Ocean Sediment Core Research Facility Marine Sediments Collection Management System

**A Master Catalogue and Collection Management Plan for the British
Ocean Sediment Core Research Facility Sample Collection**

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1. Executive Summary

The British Ocean Sediment Core Research Facility (BOSCORF) is widely recognised in the environmental science community as possessing an extensive collection of marine sediment core samples collected by the UK Research and Innovation Natural Environment Research Council (UKRI NERC) ships and UKRI NERC-funded researchers. BOSCORF provides long-term storage of the sediment core samples under controlled conditions to ensure optimum preservation. In 2010, the repository was deemed full, and has subsequently been storing new acquisitions in sub-optimum conditions. In 2017, the BOSCORF steering committee (SC) was convened to examine ways in which the collection management could be amended to alleviate pressure in the overcapacity cold store.

The BOSCORF SC charged the Curator with the task of creating a Marine Sediments Collection Management System (MSCMS), which included developing criteria for evaluating current collections and to establish an operating plan and set of standard practices for handling, identifying, and managing future sample collections. Policies and procedures would be based on extant best practices established by the U.S. Geological Survey (USGS).

1.1. Policies

Several basic policies, summarised below, are recommended in order to standardise operations across the marine sediment core collection currently housed at BOSCORF.

- The BOSCORF Curator should oversee MSCMS implementation.
- BOSCORF operating procedures should conform to the MSCMS standards conforming to international standards (outlined by the USGS).
- The BOSCORF Advisory Group and BOSCORF Executive Board should evaluate the collections for retention or disposal according to strategies outlined in this report.
- BOSCORF staff are responsible for metadata capture and sample identification.
- The BOSCORF Curator should establish procedures for access (including loans and re-sampling) to its collections.
- All samples remain UKRI NERC property unless properly transferred to another entity.

1.2. Procedures

The MSCMS Collection Management Plan provides a set of protocols and templates for the collection, including access, storage, transfer, and disposal of physical sediment samples and data. This applies to all sediment samples collected by UKRI NERC funded projects and UKRI NERC ships.

To evaluate the collection already in BOSCORF charge, a “decision tree” (outlined in this management document) was developed to use the sample metadata to determine the disposition of any sediment core. Each major step in the process has standard forms for documenting the decision to retain, transfer, or discard a sediment core.

For newly collected sediment core samples, Principle Investigators (PIs) will enter pertinent information into a template for the BOSCORF database upon return from the expedition.

Metadata elements for each new sample will include sample number, geographic location, collector, date collected, sample type, project name, and other significant attributes.

For the first 3 years after the sediment cores are collected they will be under the responsibility of the PI who will ensure their storage at +4°C (with the exception of sediment cores that need to be kept frozen) and careful maintenance. The sediment cores will be transferred to the BOSCORG repository where they will be stored at +4°C.

When the samples are no longer required as part of the UKRI NERC research grant that funded their collection, the sediment cores should be transferred to the BOSCORG repository and evaluated for long-term retention. It is likely that most sediment core collections will be considered suitable for long-term retention and will remain at the repository. However, if the samples should have no further research value, their disposition to an outside entity may be considered.

1.3. Implementation

The general consideration for implementation of the MSCMS is that the BOSCORG repository will form the core of MSCMS and that all participating UKRI NERC funded PIs will adopt proposed MSCMS methodologies.

A BOSCORG Executive Board consisting of the BOSCORG Advisory Group and selected UKRI NERC members should be formed to coordinate MSCMS implementation and operation; the board would also provide direction and advice to the Curator with regards to sample retention and disposal.

1.4. Conclusion

Developing common practices in the collection, retention, and disposal of marine sediment materials in the BOSCORG is critical to the management of those materials. Successful implementation of the MSCMS business plan will allow for improved use of these resources, economy of effort through data sharing, and better accountability of BOSCORG activities, past and present. It may also serve as a model for other UKRI NERC facilities in the management of their sample materials.

N.B. From October 2018 the BOSCORG Steering Committee will be replaced by the BOSCORG Advisory Group.

2. Introduction

2.1. Background

The British Ocean Sediment Core Research Facility (BOSCORG) is a unique and internationally-recognised facility providing the UK community with some of the most comprehensive core logging facilities available in Europe. It provides research facilities used in all UKRI NERC Theme Science Priority Areas and contributes directly to UKRI NERC Directed and Core Programmes and high-profile international projects. Its state-of-the-art facilities underpin crucial UK research in all areas encompassed by the UKRI NERC mission.

BOSCORG was founded as a UKRI NERC facility in 1997 and the sediment core repository was extended in 2001, this extension was envisaged as providing storage for the next ten years of core acquisition (i.e. to 2011). Since 2001, BOSCORG's sediment core holdings have increased very significantly with 2014 alone seeing a 20% increase in core material held. In 2018, the total volume of sediment cores held within BOSCORG was 8.8 km, which equates to £295 million investment by UKRI NERC in ship time for their collection.

Since 2014, the number of users per year has more than doubled and the number of Ph.D. students supported by the facility has increased threefold. Recent years have also seen a marked widening of the BOSCORG user base to include archaeologists, geographers and biomedical researchers in addition to marine geologists. This demonstrates the importance of BOSCORG facilities in a wide range of research areas.

2.2. Overview

The establishment of the Marine Sediment Collections Management System (MSCMS) was recognised as something both desirable and necessary by the BOSCORG SC. The first part of this paper outlines those issues and provides answers to the questions raised during the process of establishing the rules and guidelines that will govern the MSCMS. (Issues Addressed by the Marine Sediments Collection Management System, Section 3)

The middle section of this document stipulates the policies and procedures that will standardise the handling of samples and the metadata that will be required for their documentation (Operating Plan for the Marine Sediments Collection Management System, Section 4).

The initial effort that will be required to establish the MSCMS cannot be understated. Sediment core collections will need to be evaluated, retained samples will need proper documentation, and data entry of pertinent information will be required. The final section of this document outlines the best way to facilitate the implementation of the MSCMS (Implementation of the Marine Sediments Collection Management System, Section 5).

3. Issues Addressed by the Marine Sediments Collection Management System

3.1. Why does BOSCORG need a Marine Sediments Collection Management System?

Marine sediment core collections are acquired by the BOSCORG using taxpayer's money and constitute a valuable resource to the UK and its citizens. These collections remain the property of the UKRI NERC unless they are deemed to be of no further scientific value. Since the BOSCORG was established in 1997, thousands of samples have been amassed and range from localised, geographically based samples to collections that are of international significance. The majority of the collection is well-established and well-documented, most with sample metadata available online, while other samples remain poorly catalogued. The MSCMS will provide a common model for sample expeditions, data entry, and access by research personnel and will allow the collections' resources to be utilised to their full potential. Further, by providing standards for retaining collections and provisions for relinquishing them, the MSCMS will facilitate an evaluation of the continuing benefits of the collections.

3.2. What sample metadata are required?

A sediment sample has little research value without the information that defines what it is and where it was collected. At a minimum, a sample requires a unique identifier and the geographic coordinates of the location where it was collected. The name of the person who collected the sample and the date on which it was collected are also critical pieces of information for locating the ancillary records associated with the sample, such as the expedition report, station location map, and associated analytical results. If these metadata points—what, where, who, and when—are not available, there may be little reason to retain that sample.

For many legacy collections, sample metadata might not be available beyond the number, location, collector, and date. For resource, active, and new collections, however, MSCMS guidelines stipulate that metadata such as sample type, reason for collection, project name, and analyses performed should also be entered into the database. In the catalogue, locations might be physically described as well as geospatially defined; photographs or petrographic descriptions can also be included. Appendix 1 lists the sample metadata (attributes) that the MSCMS will compile for its catalogues of sediment materials. Additional information that the MSCMS will provide to customers will be how to access the sample, and whom to contact for further information.

3.3. What will not be included in the MSCMS?

Sediment materials can be thought of as having two main components: (1) the physical samples collected by principal investigators (PIs) and (2) the data generated by analysis of those samples, by instrumentation-based field surveys, and from laboratory-based research. The MSCMS will deal primarily with the physical samples and their ancillary documentation—what the samples are, where they are located, how they are managed, and how to access them. Because many of the analytical results associated with the samples are already being captured in various formats and are available online, links to those databases, as well as links to those publications resulting from the research associated with the BOSCORG sample collections, will be provided where possible.

The MSCMS will not specifically address the preservation of digital data (laboratory based measurements) or conventional library materials (cruise reports, books, journals, monographs). BOSCORG is developing, however, a larger cyberinfrastructure that eventually will integrate metadata for all databases of physical objects and digital information, and links between samples and data will be established where needed. Please refer to the section below for a discussion of how the MSCMS contributes to the overall BOSCORG strategy for preserving sediment sample data and materials.

3.4. How does the MSCMS fit into the BOSCORG data preservation strategy?

One of the BOSCORG goals is to provide a system that not only preserves sediment materials and data, but also provides the means to make them available to the scientific community. As part of this effort, the BOSCORG is developing a comprehensive data management structure, a cyberinfrastructure that organises and connects the various catalogues, data, and information within the BOSCORG and the larger marine and geoscience community. The BOSCORG website will facilitate access to the information within that network.

4. Operation Plan for the Marine Sediment Collections Management System

4.1. Mission Statement

BOSCORF is the UK's national marine sediment core research facility and provides a unique and strategic service to the scientific community. It provides some of the advanced non-destructive core logging and analysis capabilities. BOSCORF also provides specialised long-term sediment core storage facilities, so that sediment cores collected by UKRI NERC ships, and UKRI NERC-funded researchers, can be kept under optimum conditions to ensure long-term preservation, and availability to the scientific community. BOSCORF promotes multiple usage of the sediment core material in its care ensuring cost-effective exploitation of an important national scientific resource. It is also responsible for long-term curation of sediment core-based data relating to its holdings and from core-based national marine programmes in compliance with UKRI NERC data management policy. The MSCMS supports this mission through the facility's data integration effort by creating a uniform infrastructure and standardised master catalogue of the marine sediment sample collection. Further, as a virtual network linking physical collections, the MSCMS facilitates access to these samples by BOSCORF staff and the scientific community through a Web-based portal. By developing and sharing a set of common business and management practices, the MSCMS helps to promote the long-term preservation of these national resources.

4.2. Vision Statement

The MSCMS provides a platform for uniform business practices in the collection, description, and management of those samples. The MSCMS addresses three areas of concern in making these collections as useful as possible.

4.3. Collection

- The MSCMS provides guidance and templates for standardised and consistent procedures in the collection and description of samples by PIs during expeditions (Appendix 2).
- The MSCMS stipulates and defines the categories of information that are used to describe an individual sample, such as an identifying number; where, when, and by whom it was collected; sample type and purpose; and other significant pieces of metadata.
- The MSCMS specifies protocols for future use of the samples.
- The MSCMS provides standards for incorporating samples from sources outside BOSCORF.

4.4. Management

- The MSCMS promotes the long-term preservation of marine sediment collections by identifying the individual samples, where they are kept, and how they are stored.
- The MSCMS provides guidelines for the deaccessioning or disposal of samples from collections, including provisions for transfer to other entities.

4.5. Access

- The MSCMS provides metadata through the BOSCORG website to allow customers to locate samples within a geographic area or scientific expedition.
- The MSCMS promotes and provides methods for linking to the analytical data associated with a sample, where possible.

4.6. Policies Governing the MSCMS

Because of its extensive collections of sediment core materials, the BOSCORG is undertaking the development of standard methodologies for handling physical samples collected with public funds. To this end, BOSCORG has developed a scheme that will improve both tracking of, and access to, the samples and their ancillary information. This scheme stipulates a minimum set of standards to improve the identification, maintenance, and preservation of physical sediment samples. It is flexible and open to modification by the individual scientists, and it should be reviewed periodically at the BOSCORG Executive Board level for updates, amendments, and improvements. All users will have the opportunity to provide input for continual improvement, through the BOSCORG Advisory Group and user feedback forms. Finally, the protocols and templates provided by the scheme for the collection, storage, access, transfer, and disposal of physical sediment samples embody the desired best practices for the BOSCORG repository.

The following policies were formulated to help establish a framework and standardise operations among the varied users and expedition PIs:

1. The BOSCORG Executive Board should oversee the governance, implementation, and operation of the MSCMS.
2. The BOSCORG staff will adhere to the policy document and collection management plan that governs and guides the organised handling, storage, preservation, and tracking of samples; the plans will conform to the basic standards of the MSCMS. Appendix 3 provides templates for these documents. The MSCMS metadata template should be used for cataloguing the samples.
3. The BOSCORG Advisory Group will be responsible for evaluating the collections for retention, transfer, or disposal according to the guidelines laid out in this document. All materials should be assessed on the basis of their long-term research value and the existence of ancillary geologic/marine records. Collections that do not meet the minimum criteria should not be retained or transferred; the procedure for disposal is outlined in this document.
4. BOSCORG Executive Board will be responsible for authorising sediment core disposal.
5. BOSCORG Executive Board will be responsible for authorising accessioning donated sediment cores.
6. As the MSCMS is developed and implemented, researchers are required to submit sample metadata to the BOSCORG Curator when they return from their expeditions. The PIs should have exclusive use of the samples for the duration of the project for which they were originally collected, but registration of the samples in the MSCMS

should occur when the samples enter the repository. When that project is over, or within a predetermined period from the time of collection, the samples will be made accessible to the scientific community.

7. At no time should the samples leave BOSCORG custody without evaluation by the BOSCORG Advisory Group and documentation for their transfer or disposal.
8. Access to samples within the repository should be determined on a case-by-case basis and would be based on BOSCORG policies.

4.7. Recommended Procedures

The protocols outlined below are recommended practices developed for the BOSCORG repository and PIs collecting marine sediment samples with UKRI NERC funded grants and on the UKRI NERC research ships (Appendix 2). These procedures are in compliance with the policies of the MSCMS and provide guidance to all users. The protocols are not meant to be onerous, but are meant to serve as examples and guidelines for the curatorial staff and sample collectors overseeing the implementation of the MSCMS.

4.8. Evaluation of Collection—Applying the 3-Point Standard

The marine sediment core collection within the BOSCORG repository should be re-evaluated using the guidance of the MSCMS: legacy, active, new, and donated collections will all be evaluated. The preliminary criteria for these evaluations can be found in figure 1. This decision tree was based on the USGS schema and the mandatory sample metadata specifications (Appendix 1). Each major component in the tree - inventory and evaluation, retention, transfer, or disposal - has standard forms for documenting the relevant process (Appendix 3). Use of the tree allows the Curator and BOSCORG Executive Board to establish the appropriate course of action regarding the disposition of samples.

It is recommended that the entire legacy collection be evaluated. For these sediment cores, it should be determined if the minimum ancillary data exist for the individual samples to be useful. There are three required data points for these samples, known as the 3-point standard: the identification number is clear on the sample, basic metadata is available, and the sample is in a reasonable condition.

Evaluation form in Appendix 3 will be used to record pertinent details about the collection and whether the sediment material will be retained.

If the criteria cited above are not met, there should be compelling evidence to justify keeping the sample, which will be made available to the BOSCORG Executive Board. One example might be an important stratigraphic record from a rarely sampled location, but for which limited metadata are available. In this case, the sample could be kept. Otherwise, most samples not meeting the 3-point standard may be made available for use outside BOSCORG (e.g. to HEIs).

Active collections are subject to the same standards as legacy collections. In most cases, however, the three required data points will be readily available for these samples, and the collector can provide additional pertinent information. For newly collected samples, the scientist should endeavour to gather as much information as possible that conforms to the MSCMS preferred sample data criteria.

During the evaluation process, if any legacy or donated collection is determined to have possible long-term historic or scientific value, the samples will be prioritised for retention based on records of sample within the last 5 years.

There are occasions when BOSCORG receives collections from outside entities, such as academic or industrial sources, because the care and preservation of those collections cannot be properly maintained by their current repositories. If they are of scientific value to UKRI NERC and UK scientists, these donated collections should be evaluated in the same manner as legacy collections.

4.9. MSCSM Metadata Catalogues

MSCMS outlines the management approach for the digital inventories of the sediment core collection. Currently, the Microsoft Office Suite is the standard software package used by BOSCORG for document, spreadsheet, and database production. The preferred Microsoft Excel template is the Index to Marine and Lacustrine Geological Samples (IMLGS) standard layout for the MSCMS metadata catalogue, in accordance with the MSCMS preferred sample data (Appendix 1), which can be used for data input in the MSCMS inventory. This template provides fields for indexing the required attributes and provides options for some of the descriptive elements.

4.10. Cataloguing Sample Data

As the legacy collections are being evaluated, data for the samples deemed appropriate for retention should be checked in the MSCMS inventory. In addition to the 3-point standard used to evaluate the samples, where it is housed in the repository is also required. If additional descriptive data are available, that information should be recorded as well.

For new samples, data input should be initiated upon return from the expedition. Again, the collector should endeavour to provide as much information as possible about the origin and nature of the sample. While it is true that some current or future samples may not be judged suitable for long-term retention in the MSCMS, capture of their descriptive data at the beginning of their scientific lifecycle is the standard to which the PIs should adhere (Appendix 2).

All sample data should conform to the policies set out in the BOSCORG data management plan.

4.11. Inclusion of Sample Metadata in online catalogues

The metadata catalogues, indexes, and published records of sediment core data and samples available within the BOSCORG and provides a means to digitally access them. Samples and collections indexed in the MSCMS master catalogue should automatically be incorporated into online catalogues.

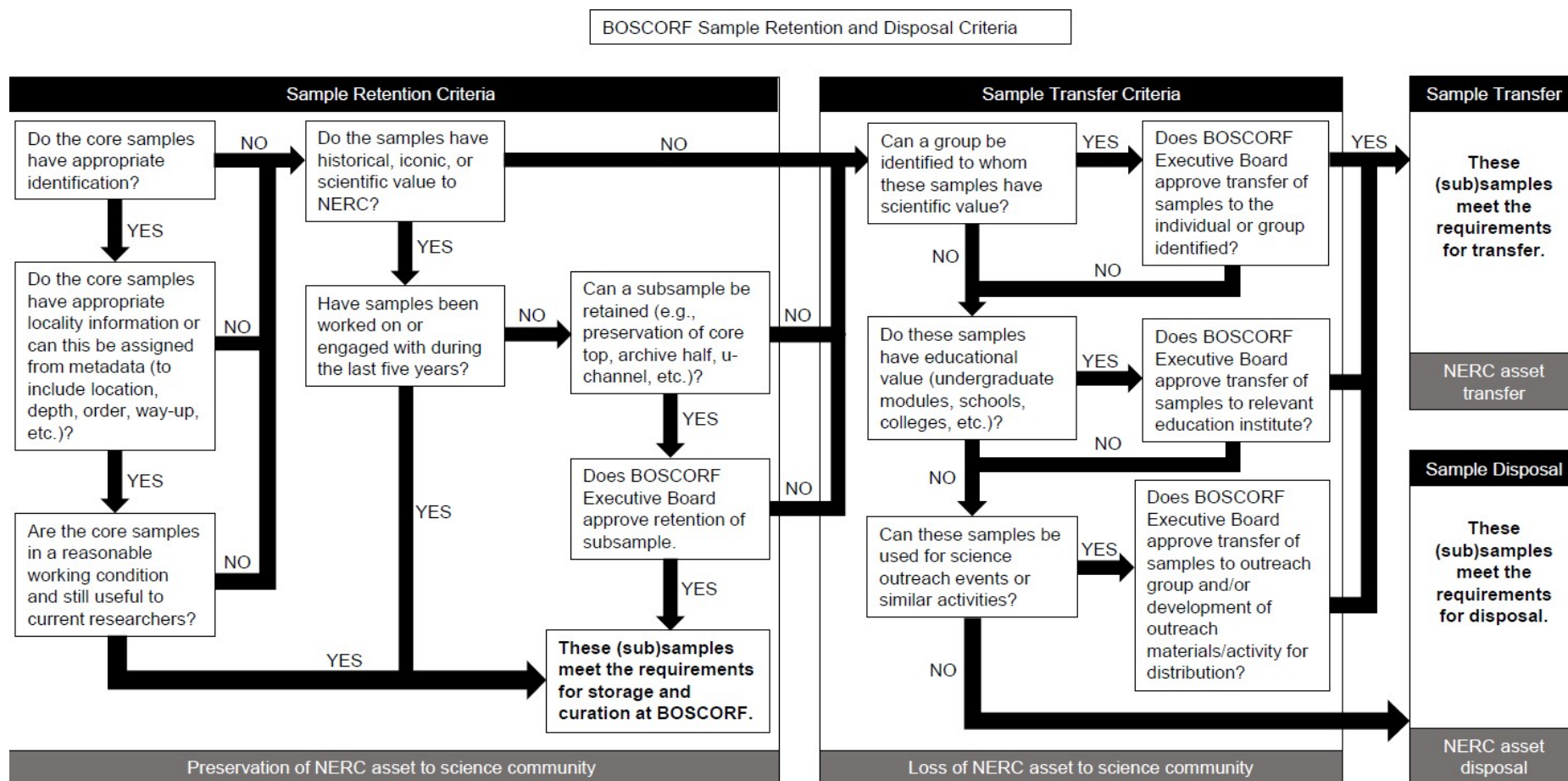


Figure 1. BOSCORG Sample Retention and Disposal Criteria used by the Marine Sediments Collection Management System is a graphical representation of the factors to be considered when evaluating a sediment sample for retention or disposal

4.12. Labelling Samples

Many MSCMS samples will initially be labelled with an expedition number assigned to them by their collector. Upon entry to the MSCMS, the samples should be checked to ensure it is a unique identifier within the repository. The number may be directly applied to the sample or written on a separate label and inserted into the bag or box containing the sample.

The unique identifier should be sufficient to link that sample with all pertinent information in the MSCMS master catalogue. All sample identifiers, expedition numbers, and unique identifiers should be recorded in the online catalogue.

4.13. Recommended Sample Storage

The focus of the repository is to preserve the physical integrity of its holdings and maximise sample longevity for its use in future scientific research. It is recognised that various sample types will require varying methods of storage and climate control to maximise that longevity. Therefore, the physical management of MSCMS collections would be under the purview of the Curator.

Ideal sediment core storage consists of d-tube sample boxes contained on racks, each box clearly labelled, to allow immediate access to any sample in the repository. PIs are responsible for providing d-tubes for the samples (through their research and cruise funding). Because this is an expensive storage method, some sediment core samples will be stored in layflat tubing on shelves in the repository. In this case, samples are stored in sub-optimum conditions and this method should be avoided where practicable. Sediment cores stored in layflat tubing should be labelled clearly, especially on the end viewed facing out of the shelf.

4.14. Secondary Sampling a Collection

Secondary sampling (also known as re-sampling) is the act of retrieving an archived sample for the purpose of additional scientific inquiry, be it a geochemical analysis, age determination, or testing of physical properties. It is the authority of the Curator to approve a sample's suitability for secondary sampling. Requests should be evaluated by the Curator on the basis of sample availability and the merits of the request; the collecting scientist should be consulted during the moratorium period. The BOSCORF Advisory Group should be consulted for evaluating core tops samples. No more than half of any sample should be given out at any one time, and where possible a half portion of the archive section should remain until all non-destructive measurements have been obtained.

4.15. Protocols for Secondary Sampling

If a sample request meets the criteria for re-sampling, the requester will complete and sign a sample request form (Appendix 3), acknowledging the conditions of the sampling.

The sample requester would be subject to the following conditions:

- Sub-samples—In the sampling request, the requester should inform the BOSCORF of all tests and alterations intended for the samples while in the requester's care. Requests

may be denied if there is not enough sample material for the intended analyses. Samples requested should be used only for the research and data extraction purposes stated on the Sample Request form.

- Use of Samples—Samples are issued for the sole use of the person or persons stated on the Sample request form. The requester should not loan, deliver, lease, or transfer the samples to any other entity.
- When publishing the results of any resultant research, the requester should clearly state that the samples belong to the BOSCORF.

4.16. Protocols for Sample Loans

Borrowing samples for non-destructive analysis follows the criteria set out in the loan agreement form (Appendix 3). A copy of the Loan Conditions form will be provided to the borrower for his or her own records.

The borrowing party will be subject to the following conditions:

- Term of Loan—The sample should be returned to the repository at the borrower's expense, no later than the negotiated due date stated on the Loan Agreement, or within one week after an earlier return is requested by the curator.
- Use of Samples—Samples loaned are for the sole use of the person or persons stated on the Sample Loan Agreement. The borrower should not loan, deliver, lease, or transfer the samples to any other entity. When displaying the samples or publishing the results of any resultant research, the borrower should clearly state that the samples belong to the BOSCORF.
- Loss or Damage—It is recognized that many analyses are destructive in nature. However, unless it is agreed that the sample or parts thereof will not be returned to the repository, the borrower would be responsible to report any damage or loss of material.

4.17. Data Return

Any analytical data and findings derived from a BOSCORF sample should be submitted to the Curator within two years from the date of the original request/loan and would be permanently associated with that sample.

4.18. Physical Remains

Upon return of the sample, the borrower and the Curator should sign and date the original outgoing Sample Loan Agreement form to log the sample back into the holdings of the repository.

4.19. Deaccessioning Samples

Deaccessioning is the process by which a sample or collection is formally and permanently removed from the custody of its repository. Deaccessioning may take the form of either transfer to another entity or disposal. Deaccessioning will be authorised by the BOSCORG Executive Board.

4.20. Deaccession Criteria

The Checklist for Deaccessioning Sediment Materials form in Appendix 3 provides criteria for determining if a sample or collection should be removed from the repository. Some of these include:

- Poor condition—The sample has deteriorated or has been damaged beyond any useful value for further scientific study.
- Inadequate documentation—There are no ancillary records to ascertain where, when, or by whom the sample was collected.
- Duplication—The sample is a duplicate of another sample currently stored in the repository.

4.21. Disposition of Samples

Samples deemed inappropriate for retention by the MSCMS may still be valuable for education or outreach. Such samples may be transferred to an appropriate party external to BOSCORG. The Record of Transfer or Disposal of Sediment Materials form (Appendix 3) documents the removal of samples from the care and responsibility of the MSCMS to a recipient institution or individual. This form requires the following information:

- proposed fate of the samples (education, research, and so forth),
- institution or affiliation of the recipient, and
- date of deaccession.

4.22. Disposal Criteria

If samples proposed for deaccessioning are in such a state that they are deemed unusable for further study, because of natural deterioration or destruction of sample integrity by analytical procedures, said samples will be subject to appropriate disposal.

Samples of sedimentary materials may contain heavy metals, poisonous chemicals, or other hazardous pollutants. The Curator should determine any special disposal needs and consult the appropriate authority (local safety officers and NOC estates) to determine the most suitable course of action.

5. Implementation of the Marine Sediment Collections Management System

The general consideration for implementation of the MSCMS is that the BOSCORG repository will form the core of MSCMS and that all participating UKRI NERC funded Principal Investigators will adopt proposed MSCMS methodologies.

A BOSCORG Executive Board consisting of the BOSCORG Advisory Group and selected UKRI NERC members should be formed to coordinate MSCMS implementation and operation; the board would also provide direction and advice to the Curator with regards to sample retention and disposal.

The Curator will:

1. develop procedures for sample handling and preservation that adheres to MSCMS protocols;
2. use the MSCMS decision tree to evaluate individual samples and collections in order to determine which are appropriate for retention;
3. catalogue the samples that are to be retained by entering the required metadata into the BOSCORG database;
4. implement procedures to store samples for optimum preservation and develop access and loan protocols for future retrieval;
5. retain data collected from the samples in the BOSCORG database.

The policies and procedures of the MSCMS should be reviewed periodically by the BOSCORG Advisory Group. In addition, the materials held by BOSCORG should be re-evaluated on a regular basis for appropriateness and retention. The MSCMS is a collective resource for the entire UK earth science community and the users who discover the marine sediment materials kept in the repository and seek to access them. Suggestions for improvements to this national asset should be solicited and examined for continuous improvement through the BOSCORG Advisory Group.

Appendix 1. MSCMS Preferred Sample Data

The attributes listed in the table are the minimum required metadata categories for BOSCORF samples and form the basis for the MSCMS data catalogue template.

Ship/Platform	Vessel name
Cruise Identifier	Expedition/cruise number
Sample Identifier	Unique within a cruise (for a sampling device), maximum 30 alphanumeric characters
Date Sample Collected	YYYYMMDD
Latitude	+/-DD.DDDDD (maximum five decimal places; - = S or W):
Longitude	+/-DDD.DDDDD (maximum five decimal places; - = S or W):
Water Depth	Corrected meters, no decimal, 5 digit integer
Sampling Device	(see device list https://www.ngdc.noaa.gov/mgg/curator/curatorcoding.html)
Storage Method	(see storage list https://www.ngdc.noaa.gov/mgg/curator/curatorcoding.html)
Core Length	6 digit integer total length in centimetres
Core Diameter	3 digit integer, in centimetres (round to nearest whole centimetre and place real value in comments field, if necessary)
Principal Investigator	(last name, first name of P.I.) up to 26 characters
Physiographic Province	(see province terms list https://www.ngdc.noaa.gov/mgg/curator/curatorcoding.html)
Ocean/Sea Name	
Leg	Leg within cruise, or alternate/standard leg identifier
Sediment Type	Description of sediment e.g. clay, sand, ooze, etc.
Sample Comments	Up to 2000 characters of comments pertaining to entire sample, do not use nonstandard characters

Appendix 2. Guide to Marine Sediment Cores Acquisition and Accessioning into the BOSCORG Collection

British Ocean Sediment Core Research Facility

Guide to Marine Sediment Cores Acquisition and Accessioning into the BOSCORG Collection

The British Ocean Sediment Core Research Facility (BOSCORG) is the UK's only national deep-sea sediment core storage and research facility. BOSCORG is part of NOC National Capability (NC) providing a unique and strategic service to the entire UK research community. Deep-sea sediment cores are an exceptional resource of immense scientific value, providing a vital source of information on the past history of the Earth system processes.

BOSCORG was commissioned under Natural Environment Research Council's (NERC) NC Large Research Infrastructure (LRI) portfolio in October 2018. NERC NC-LRI provides for specialist, large research infrastructure that enables excellence and impact in national to global-scale environmental science.

The BOSCORG facility provides disproportionate increases in scientific returns for modest incremental investment compared to the original investment in ship time to collect the sediment cores. BOSCORG is heavily constrained by its current capacity and capability.

The specialist storage facilities currently provided by BOSCORG safeguards the ~£295 million asset investment by NERC to collect the sediment cores. Without specialist storage, sediment cores rapidly degrade (desiccate and fracture) within months, limiting their utility for further research, and resulting in a loss of assets and failure to reach full benefit realisation of multiple NC-LRIs. There is no other national repository for storing deep-sea sediment cores in the UK. A fundamental objective within BOSCORG's mission is to have open access to sediment cores for scientists, and to promote re-usage by providing specialised facilities for the long-term storage and curation of cores.

As a necessary response to the total sediment core storage capacity being reached, on 1st October 2018 BOSCORG introduced a 'one-in-one-out' policy: for every sediment core received, a similar length of stored sediment core is removed and decommissioned. This will seriously degrade NERC's ability for long term archiving of sediment cores.

Purpose of this Guidance Document

This document provides guidance to UKRI NERC funded scientists regarding the acquisition and accessioning of marine sediment samples into the BOSCORG. This guidance addresses policy set out in the 'BOSCORG Marine Sediments Collection Management System'.

Recommendations for Sample and Metadata Management

This document sets out a summary of BOSCORG's sample management system, which adheres to international best practice. The protocols outlined here ensure that sediment cores can be reused effectively beyond the initial funded programme, and therefore benefit the entire research community. Principal Scientists are responsible for the implementation of these sample management protocols to facilitate the long-term curation of sediment core samples. If this standard practice is not followed, the preservation of the samples cannot be guaranteed by BOSCORG.

British Ocean Sediment Core Research Facility

Sample Metadata

The attributes listed in the table are the minimum required metadata categories for BOSCORG samples.

Ship/Platform	Vessel name
Cruise Identifier	Expedition/cruise number
Sample Identifier	Unique within a cruise (for a sampling device), maximum 30 alphanumeric characters
Date Sample Collected	YYYYMMDD
Latitude	+/-DD.DDDDD (maximum five decimal places; - = S or W):
Longitude	+/-DDD.DDDDD (maximum five decimal places; - = S or W):
Water Depth	Corrected meters, no decimal, 5 digit integer
Sampling Device	(see device list https://www.ngdc.noaa.gov/mgg/curator/curatorcoding.html)
Storage Method	(see storage list https://www.ngdc.noaa.gov/mgg/curator/curatorcoding.html)
Core Length	6 digit integer total length in centimetres
Core Diameter	3 digit integer, in centimetres (round to nearest whole centimetre and place real value in comments field, if necessary)
Principal Investigator	(last name, first name of P.I.) up to 26 characters
Physiographic Province	(see province terms list https://www.ngdc.noaa.gov/mgg/curator/curatorcoding.html)
Ocean/Sea Name	
Leg	Leg within cruise, or alternate/standard leg identifier
Sediment Type	Description of sediment e.g. clay, sand, ooze, etc.
Sample Comments	Up to 2000 characters of comments pertaining to entire sample, do not use nonstandard characters

A template for recording the preferred sample metadata can be provided upon request (boscorg@noc.ac.uk).

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Sample handling and labelling

After a sediment core is brought from beneath the seafloor to the deck of the ship, it is removed with its protective core liner from the outer core barrel. The core liner containing the cored material is wiped clean, and the liner is marked and cut into 1 or 1.5-m sections. The last section may be shorter than 1.5 m, depending on the total length of recovered core. Each section of the sediment core is capped with endcaps at the top and bottom of each section, using (38mm wide) insulation tape to seal the caps to the liner. Material in the core catcher of the outer core barrel is placed in a short section of core liner, similarly capped, and placed below the last core section.

Each section is permanently labelled with its identification number:

Core sections should be labelled numerically with the topmost section of the core labelled as Section 1, followed by Section 2, 3, 4, etc. down core.

Core sections should be labelled with appropriate way-up markers, e.g. upward-pointing arrows and top and bottom labels on end caps. If possible, two continuous lines (red and blue) should be drawn along the entire length of the core liner before it is cut into sections. This will ensure that the core sections can be split, imaged, and analysed along the same plane, as well as enabling the palaeomagnetic analysis.

BOSCORG would prefer sediment cores to be split under controlled conditions in the BOSCORG laboratory as part of a post-cruise splitting party. This enables essential data collection on the MSCL-S and MSCL-CIS prior to drying and geochemical alteration of the sediment core surfaces. If cores are split at sea, each half should be designated as a working and archive half and labelled accordingly.

D-tubes and D-tube end caps should also be fully labelled.

Note: It is the responsibility of the Principal Scientist to purchase d-tubes. Cores will not be accepted into the BOSCORG collection without d-tubes.

International standard for sample naming

The sample identifier must be unique within a cruise and should be composed of the following components:

- Cruise identifier
- Coring device
- Core number

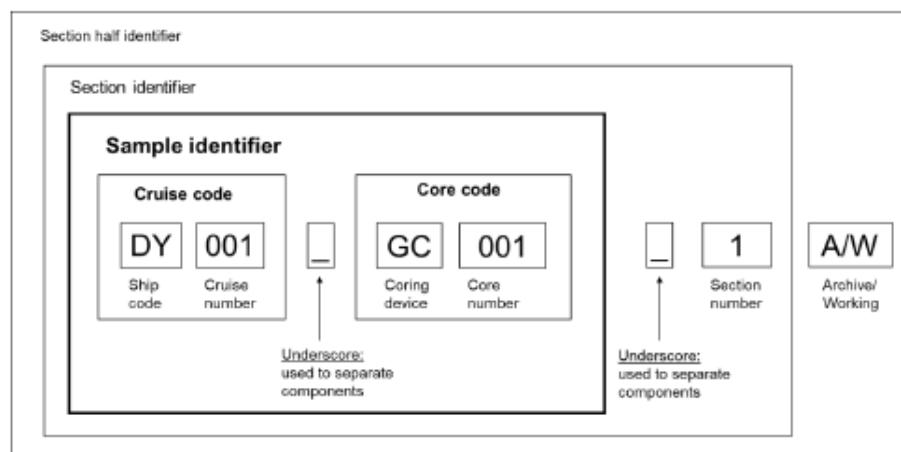
In the example shown in the diagram below:

- Sample identifier: DY001_GC001
- Section identifier: DY001_GC001_1
- Section half identifier: DY001_GC001_1A or DY001_GC001_1W

Note: It is compulsory that sediment cores are named using this international standard. BOSCORG will rename sediment cores entering the collection that are not in this format.

British Ocean Sediment Core Research Facility

The unique sample identifier and labelling should follow the format shown below:



Reserving sample storage

For samples originating from expeditions funded by NERC, it is the responsibility of the Principal Scientist to ensure that there is storage space available to accommodate the incoming samples prior to the expedition. Sample storage requirements should be discussed with the BOSCORF Curator during the project planning phase to determine if storage space can be allocated. BOSCORF is at maximum capacity and cannot guarantee that samples can be stored in the repository. Samples that are approved for accessioning must be accompanied by complete sample information, sample metadata and conform to BOSCORF sample standards.

Note: samples that are in poor condition and are of limited scientific value may not be accepted. Due to space limitations replicates samples will not be accepted without scientific justification. BOSCORF is a sediment core repository at capacity, there will not be accepting non-sediment core material.

An accession record form will be issued following the transport of sediment cores to BOSCORF repository.

Accessioning

On delivery of the samples to the BOSCORF repository, sample condition is evaluated and all metadata are checked and uploaded to the BOSCORF website. All samples are relabelled to conform to the BOSCORF standard (if necessary) and racked/shelved. All piston and gravity sediment cores are systematically logged on the standard Multi Sensor Core Logger (MSCL-S) within 3 months of entering the repository. The data quality is highest from unsplit 'fresh' sediment cores. Therefore it is BOSCORF policy to collect MSCL-S data as soon as practicably possible. This data is made available to the Principle Scientist within 1 month of analysis.

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With the agreement of the Principal Scientist, all piston and gravity sediment cores are split and line scan imaged (on the MSCL- Core Imaging System). This is followed by the collection of spectrophotometer and magnetic susceptibility data from the MSCL-XYZ system. This data is made available to the Principle Scientist within 1 month of analysis.

Sample moratorium

Sampling requests received within 3 years of sediment core collection will be passed to the Principal Scientist who will assess whether the request is in conflict with his/her own research interests. If there is no conflict the request will be granted. If there is a conflict the sampling request will need to be resubmitted after the 3-year period.

Sample discovery

During the moratorium period basic sample metadata will be listed on the BODC cruise report webpage (https://www.bodc.ac.uk/resources/inventories/cruise_inventory/search/) and on the BOSCORF repository holdings webpage (<https://boscorf.org/repository/repository-holdings>). Beyond the moratorium period, sample metadata for cores accessioned to the BOSCORF collection will be listed on the Index to Marine and Lacustrine Geological Samples (<https://data.nodc.noaa.gov/cgi-bin/iso?id=gov.noaa.ngdc.mgg.geology:G00028>).

Subsampling of sediment cores

Records of sediment core subsampling should always be provided to BOSCORF. There are no restrictions on subsampling by the cruise principal scientists during the moratorium period. Requests sent to BOSCORF for subsampling during the moratorium period will be communicated to the principal scientist for approval.

Secondary sampling of sediment cores

Secondary sampling refers to subsampling of cores beyond the moratorium period and it is the authority of the Curator to approve a sample requestor's suitability for secondary sampling. Requests are evaluated by the Curator on the basis of sample availability and the scientific merits of the request. The BOSCORF Advisory Group is consulted for evaluating core tops samples and large volume requests.

Sample requests forms can be downloaded from the BOSCORF website (<https://boscorf.org>).

Analysis of sediment cores

Requests for core-splitting and non-destructive measurements on sediment cores should be submitted to the Curator at the earliest possible time. Principal scientists are advised to contact BOSCORF to discuss the analytical requirements of their projects prior to research cruises and expeditions taking place.

Analysis request forms can be downloaded from the BOSCORF website (<https://boscorf.org>).

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Data moratorium

According to the NERC data policy: *"NERC expects everyone that it funds to manage the data they produce in an effective manner for the lifetime of their project, and for these data to be made available for others to use with as few restrictions as possible, and in a timely manner".*

It is the responsibility of individual researchers and principal scientists to submit ~~this~~ data to the appropriate NERC data centre.

BOSCORG archives all raw data acquired from its suite of non-destructive analytical instruments. These data are typically protected by a two-year moratorium during which time the data are available only to the project participants. For lengthier projects and for projects that are associated with PhD studentships, it may be possible to protect the data by a moratorium extending for a maximum of five years.

At the end of the agreed data moratorium, raw data will be made openly available and accessible by request to the Curator.

Appendix 3. BOSCORG Marine Sediments Collection Management System sample management forms

The forms in this appendix are documentation for the evaluation and tracking of the collections. They provide a uniform format for gathering the information necessary to fulfil the requirements of records retention. The documentation supports the decision tree (Figure 1).

1. Sample Evaluation Form - used to perform initial evaluation of any sample or collection
2. Sample Accession Agreement - used to accept sediment materials into the repository
3. Sample Request Form - lists samples being provided to researcher
4. Sample Loan Agreement - Lists terms and conditions of the sediment core sample loan
5. Record of Transfer or Disposal of Sediment Cores - documents ultimate disposition of materials removed from the repository.

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email: boscorf@noc.ac.uk web: www.boscorf.org

This form should be used in conjunction with the 'BOSCORG Sample retention and Disposal Criteria' decision tree and should follow the guidance detailed in the BOSCORG Marine Sediments Collection Management System.

SECTION 1			
Date of sample evaluation:		Cruise/project:	
Name of PI:			
Department of PI:		Institute of PI:	
Postal Address of PI:			
Email of PI:			
BOSCORG staff overseeing evaluation:			

[illegible]

Sample Evaluation Form

SECTION 3			
Sample evaluation		Yes	No
1	Is the sample in the custody of BOSCORF?		
2	Is the sample being recommended for deaccessioning?		
3	Has the PI or the donating organisation been consulted regarding the ongoing curation of the sample and the review of its status?		
4	Has the BOSCORF Curator/PI and/or donating organisation given approval for a change in the status of this sample?		
5	Do the metadata for this sample meet the minimum requirements as set out in the BOSCORF Marine Sediments Collection Management System?		
6	Has the sediment material deteriorated beyond useful scientific value?		
7	Is the sample iconic or does it have scientific or historic value to NERC?		
8	Has the sample been utilised for research purposes during the last five years?		
9	Is there an educational value to these samples? Could they be used for training in universities/schools/colleges?		
10	Can these samples be used for science outreach events or alternative functions?		
11	Is BOSCORF able to preserve the material in its current form?		
12	Is the sample within the scope of the purpose and mission of BOSCORF?		

SECTION 4		
Recommended action		<input checked="" type="checkbox"/>
Sample retention		
Sample transfer	To a research centre or individual researcher	
	To an educational institute	
	To another entity for outreach purposes	
Sample disposal		
Please state the reason for the recommended action.		

Sample Evaluation Form

SECTION 6			
Approval of sample deaccessioning			
	Name	Signature	Date
BOSCORG Curator			

If the sample meets one or more of the criteria for transfer or disposal, and the curator recommends and approves this action, a 'Record of transfer and disposal of sediment core samples' form must be completed.

Please note that the 'Record of transfer and disposal of sediment core samples' form must be approved by all responsible parties prior to any action being taken regarding the transfer or disposal of samples deaccessioned from the BOSCORG collection.

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The samples listed on this form are being transferred to BOSCORG for long-term storage. It is understood that the samples will be retained under moratorium for years. After this period, the samples will be made available to the scientific community for secondary sampling.

End of moratorium date:.....

SECTION 1			
Date of accession:		Cruise/project:	
Name of PI:			
Department of PI:		Institute of PI:	
Postal Address of PI:			
Email of PI:			
BOSCORG staff over-seeing accession:			

[illegible]

Sample Accession Record

SECTION 3
Please state any additional details regarding the physical condition of the samples and specific requirements for storage. Also, include any special requests regarding the moratorium period.

SECTION 4			
<u>Approval of sample accessioning and agreement of moratorium period.</u>			
The samples listed on this form are being transferred to BOSCORG for long-term storage. It is understood that the samples will be retained under moratorium for years. After this period, the samples will be made available to the scientific community for secondary sampling.			
Approved and agreed by:	Name	Signature	Date
BOSCORG Curator			
Cruise/project PI			

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Sample Request Form

SECTION 1			
Date of Request:		No of Samples requested:	
Name:			
Department:		Institute:	
Postal Address:			
Email:			
Position:			
Name, affiliation, and email address of project collaborator(s):			
Name, affiliation, and email address of PhD supervisor (if applicable):			
SECTION 2			
Project title:			
New request or subsequent/continuation of project?			
<p>Purpose of request * Please supply a project summary (minimum 200 words), including: i) objective; ii) specific geographic area; iii) role of collaborating investigators; iv) methods and procedures Sample requests will NOT be approved without this information, which is required for scientific audit purposes.</p>			

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Sample Request Form

SECTION 3			
Important additional required information (please complete all sections)			
BOSCORG is required to report to NERC on a yearly basis, to allow NERC to evaluate how much BOSCORG is supporting its other activities and advise on the quality of the science supported. Therefore please provide the following information relating to the research behind your sample request.			
Funding mode (select one):			
NERC National Capability:		NERC Strategic Research:	NERC Discovery Science
NERC Innovation funding:		NERC PhD:	PhD other:
Other funding:		Pilot Study:	
Provide NERC grant number or explain 'non-NERC funding'			
Provide NERC grant number:		Other:	
SECTION 4			
Using the NERC Scientific Classification system fill out the following:			
<u>Scientific Area</u>			
Assign % relevance (in multiples of 5) to any areas that are relevant. Otherwise, leave blank.			
Atmospheric:		Earth:	Freshwater:
Marine:		Terrestrial:	
<u>Research Area</u>			
Identify between one and five research areas that best describe your project and assign percentage relevance totalling 100%			
Palaeobiology:		Science-based archaeology:	Climate and climate change:
Palaeoenvironments:		Earth engineering:	Earth resources:
Geohazards:		Glacial and cryospheric systems:	Quaternary science:
Sediments and sedimentary processes:		Volcanic processes	Biogeochemical cycles:
Land - ocean interactions:		Ocean circulation:	Earth surface processes:
Soil Science:		Other (see NERC website for further categories):	

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[illegible]

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Sample Request Form

SECTION 6:	
Please note any special sampling, handling, packing, mailing, etc.	
Will you be here to do the sampling? Yes / No: Maybe (explain):	
DECLARATION:	
I agree to sample cores carefully and to take the minimum sample needed for my analyses. I agree to return to BOSCORG any unused samples. I agree to supply all factual results, and reports, obtained from samples taken to BOSCORG within months of taking the samples. BOSCORG will agree to hold the data in confidence for a period of months after which they will become part of the BOSCORG database available to other enquirers. I agree to supply BOSCORG with a reprint of any publication resulting from work on its cores, and to make a suitable acknowledgement to BOSCORG in any publication resulting from the study of these samples. A suggested wording is "The British Ocean Sediment Core Research Facility (BOSCORG) is thanked for supplying sediment samples".	
Name:	
Signature:	
PhD Supervisor Name (if applicable):	
PhD Supervisor Signature:	

Sample Loan Agreement

The samples listed on this form are being loaned for the purposes stated below and for the express use of the requestor named in section 1. It is understood that the samples will be returned to BOSCORF in their original state before or at the end of this loan period.

End of loan date:

SECTION 1			
Requestor information			
Date of sample loan request:		Cruise/project:	
Name:			
Department:		Institute:	
Postal Address:			
Email:			
Telephone:			
BOSCORF staff overseeing loan:			

SECTION 2						
Sample Information						
Cruise	Core ID.	Section no.	Whole/ Split	Archive/ Working/ u-channel	Length of core	Agreed analysis or purpose of loan

Sample Loan Agreement

SECTION 3
Agreed transport and storage conditions for sediment cores

SECTION 4			
<u>Approval of sample loan agreement</u>			
<p>The samples listed on this form are being loaned for the purposes stated above and for the express use of the requestor named in section 1. It is understood that the samples will be returned to BOSCORF in their original state before or at the end of this loan period.</p> <p>End of loan date:</p>			
Approved by:	Name	Signature	Date
BOSCORF Curator			
Cruise/project PI (if samples are under moratorium)			

SECTION 5
Notes on the condition in which the sediment core samples were returned.

SECTION 6			
<u>Sample return</u>			
<p>The samples listed on this form have been returned to BOSCORF in their original state as agreed.</p>			
Approved by:	Name	Signature	Date
BOSCORF staff overseeing sample return (if not Curator)			
BOSCORF Curator			
Sample loan requestor			

Record of transfer or disposal of sediment core samples

SECTION 1			
Deaccession method (please tick <input checked="" type="checkbox"/>):			
<input type="checkbox"/> Sample transfer <div style="margin-left: 20px;"> <input type="checkbox"/> To a research centre or individual researcher <input type="checkbox"/> To an educational institute <input type="checkbox"/> To another entity for outreach purposes <input type="checkbox"/> Other </div>			
<input type="checkbox"/> Sample disposal			
Date of sample deaccession:		Cruise/project:	
Transfer information (if applicable)			
Name:			
Department:		Institute:	
Postal Address:			
Email:			

SECTION 2						
Sample Information						
Cruise	Core ID.	Section no.	Whole/ Split	Archive/ Working/ u-channel	Length of core	Comment on the condition of the core samples

Record of transfer or disposal of sediment core samples

SECTION 3
Agreed transport, storage and/or disposal arrangements.

SECTION 4			
<u>Approval of sample deaccession.</u>			
The samples listed on this form are being deaccessioned from the BOSCORF collection and will be transferred or disposed of as indicated above.			
Deaccession approved:	Name	Signature	Date
BOSCORF Advisory Board representative			
NOC Management			
BOSCORF Curator			
Cruise/project PI (if samples are under moratorium)			