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Guidelines for Site Characterisation Data



INTERNATIONAL OCEAN DRILLING PROGRAMME

Guidelines for Site Characterisation Data

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1. Purpose of the SEP Data Review and Responsibilities of the Proponents

1.1. Foreword

This document outlines data requirements and recommendations for scientific ocean drilling proposals undergoing review by the Science Evaluation Panel (SEP).

Proponents should carefully review the Guidelines for Site Characterisation Data before undertaking the process of gathering, formatting and submitting the site characterisation data to the SCDB via the IODP³ Gateway. Following these guidelines helps ensure that proposals move through the SEP review process most efficiently and without unnecessary delays.

Questions regarding data submission should be directed to the IODP³ Science Office (IODP³-SO) Proposals and Meetings Manager at proposals@iodp3.org.

In addition to evaluating the science of a proposal (see **Submission Guidelines for Scientific Ocean Drilling Proposals**) SEP reviews all site characterisation data as submitted by proponents to the IODP³ Site Characterisation Database (SCDB). This ensures the highest probability of achieving the scientific objectives of a drilling/coring project. Such a comprehensive data review is required so that valuable ship time, researcher time, and funds are only allocated to projects that drill and core in the correct geographic locations and to the requisite depths, while recovering appropriate types of sediment, rock, fluid, and/or microbial samples to achieve the scientific objectives.

Proponents are responsible for demonstrating the feasibility of the proposed science via their site characterisation data and a meticulously elaborated drilling/coring strategy combining scientific objectives and available site characterisation data. Site characterisation data requirements vary according to objectives, but should demonstrate that the proposed sites are correctly positioned, and that the drill targets are adequately imaged, especially where the geological structure is complex. Every proponent team should include a proponent with a demonstrated understanding of the principles and limits of the seismic reflection method and proven ability to acquire, process and interpret geophysical data, and who can prepare statements, maps, and diagrams addressing the adequacy of the site characterisation data. Submitting additional data *beyond* what is necessary for adequate site review does *not* improve a proposal's chance of success; it may only place an extra burden on the review system.

Following each review, the SEP advises the proponents through a review report provided by the IODP³-SO in which the site characterisation data uploaded and available in the SCDB are assessed, and containing clear indications on adequacy, with details on which data are missing or incomplete, and what issues remain to be addressed (formatting, inconsistencies between seismic sections and navigation maps etc).

1.2. Proposal and Data Confidentiality

All IODP³ proposals are *confidential* documents *throughout* the nurturing, evaluation, and scheduling processes of the MSP-FB and its Advisory Panels. All individuals, who receive and review IODP³ proposals that are distributed by the IODP³-SO, acknowledge that all scientific ideas contained therein belong to the proposal authors ("proponents") and implicitly agree that they will *not disclose and not disseminate* proposal contents and will *not discuss* the proposal outside the context of their roles with the IODP³.

All IODP³ proposal documents, including:

- Site Forms

- all site characterisation data files stored in the Site Characterisation Database (SCDB) in support of the IODP³ review process, with the exception of *restricted* data files noted below
- any other required data or optional supplemental documents, flagged by the proponents in SCDB as either *release* or *hold*

become available to the expedition when the MSP-FB schedules a successful drilling proposal as an IODP³ drilling expedition.

Restricted distribution site characterisation data (e.g., confidential industry data or data covered by a Limited Non-Disclosure Agreement - LNDA) can be uploaded into the SCDB, and used to support an IODP³ proposal, with the requirement that at least a predefined subset of *minimum data* be made available in support of the IODP³ review process and be made available to the expedition when a successful proposal is scheduled as a drilling expedition. For *restricted* data the *minimum data requirement* is described in Section 5 of the **Standard IODP³ Confidentiality Policy**.

Proponents are responsible for ensuring the removal of all confidential information prior to the submission of a proposal document into the PDB, and for identifying *restricted* data files in the SCDB.

Before proceeding, please read the **Standard IODP³ Confidentiality Policy** and the **Use of Limited Non-Disclosure Agreements in IODP³** policy.

2. Data Guidelines and File Formats

The following summarises data that are fundamental to nearly every scientific ocean drilling proposal. Both the SEP and IODP³-SO enforce these guidelines and may contact proponents to ensure adherence. Definitions are given in Section 3 and recommended file formats in Section 5.

2.1. Required Digital Seismic Data

- **Single-Channel Seismic (SCS)** or **Multi-Channel Seismic (MCS)** reflection data in SEG Y format with the following header information. Note that the elements with asterisks below are *required if applicable* (either Shot Point or Common Depth Point is sufficient). The remainder of the table is *recommended*, but if the header location does *not* follow the standard as shown below, proponents must provide a similar table in a separate document describing the location of all headers in their SEG Y data files.

Property	Bytes
Trace sequence number	1-4
*Shot Point (SP) number	17-20
*Common Depth Point (CDP) number	21-24
Scalar to be applied to coordinates	71-72
(for SCS) Navigation coordinate (x) for SP	73-76
(for SCS) Navigation coordinate (y) for SP	77-80
Coordinate units	89-90
*Record length (samples/trace)	115-116
*Sample rate	117-118
(for MCS) Navigation coordinate (x) for CDP	181-184

TIP: If uploading the header information table as a separate document in SCDB, upload it using Data Type *Acquisition and Processing Parameters*, and be sure to link it to the appropriate SEGY file(s) during upload.

Acquisition and Processing Parameters should be provided for every SEGY file (or a set of SEGY files, if data were acquired and processed in the same manner) containing detailed information on the following:

Information Type	Parameter
Type and frequency content of seismic source	Acquisition
Streamer length and channel interval	Acquisition
Sample rate, record length, filters applied during recording	Acquisition
Shot interval, CDP interval, fold	Acquisition
Processing sequence including information on filters and gains applied (at what	Processing
Static corrections	Processing
Deconvolution	Processing
Multiple suppression	Processing
Stacking, type and parameters	Processing
Migration, type and parameters	Processing
Depth conversion or depth migration (for depth section)	Processing

- **Velocity Data** (collected and/or modelled) should be provided as an ASCII text file containing (1) CDP number, (2) two-way travel time (TWT), (3) stacking velocity, and (4) interval velocity organised by CDP. In addition, images showing (5) colour-coded and/or contoured velocities plotted on seismic profiles around site locations are recommended.
- **Seismic Profile Images** should be provided for all seismic profiles (interpreted and uninterpreted) with (1) clearly annotated SP or CDP numbers matching the digital files, (2) scale and vertical exaggeration, (3) orientation, and (4) information on filters and/or gains applied. In addition, interpreted profiles should show (5) proposed site locations with (6) penetration depth indicated with a vertical line extending from the seafloor to the proposed targeted depth.
- **Navigation Data** should be provided as tables (see Section 5) or in Plain Text (ASCII) format with delimited columns (comma, space, or tab) that can be reviewed using Microsoft Excel. Columns should include (1) geographic coordinates in decimal degrees and (2) either SP or CDP number. A separate navigation file is required even if the seismic file has embedded navigation data.

TIP: It is critical that the SP or CDP number and associated geographic coordinates in *decimal degrees* (-90 to 90 latitude, -180 to 180 longitude, WGS 84 georeferencing) match those indicated on the proposal Site Forms and those shown on the seismic images and maps. Every SEGY file should have an associated navigation file that is linked to it during the upload process.

2.2. Required Map Data

- **Bathymetry Data** should be submitted in digital form as a NetCDF grid, GMT (Generic Mapping Tools) grid, or Fledermaus SD or Scene file, with information on cell size in the header info.
- **Location Maps** should be provided as graphics files for each proposed *primary* and *alternate* drill site. Each map should be annotated with (1) lat/lon in *decimal degrees*, (2) colour-contoured bathymetry around the proposed site(s), and (3) seismic lines with annotated SP or CDP numbers matching the digital seismic data, seismic figures and navigational data. We recommend providing regional overview maps showing the extent of seismic data in the area, as well as local detailed maps to illustrate seafloor morphology at each site.

2.3. Other Data (may be requested by the SEP)

- If available, providing information from nearby **Wells** or **Cores** (e.g., lithology, age-depth models) or **Sample Data** (e.g., from dredged rocks) is recommended. These data can be provided as tables or text in documents.
- **Backscatter Data** (from side scan sonar or multibeam sonar) to characterise the seafloor. These data may be provided as high-resolution image files or any of the formats listed for digital maps (Section 5).
- **Seismic Interpretation Data** from seismic sections corresponding to uploaded SEG Y files are often helpful for reviewers. The interpreted seismic horizons or faults should be provided in Plain Text (ASCII) format with delimited columns (comma, space, or tab) containing (1) geographic coordinates in decimal degrees, (2) either SP or CDP number, and (3) two-way travel time (TWT) or depth.
- **Subbottom Acoustic Profiler** data (called Seismic Subbottom Profiler data in SCDB) to characterise shallow (<100 mbsf) sub-bottom structures and stratigraphy could be requested (using 3.5 kHz, CHIRP, Parasound, or Topas systems). These data should be provided as SEG Y files, with associated Seismic Profile Images, in a similar fashion as MCS and SCS data.
- **Seafloor Imagery** is recommended if drilling/coring into a hard, irregular outcrop, e.g. a reef or a basalt outcrop. These data must be provided in a recommended image or video format.
- **Magnetic** and **Gravity** data are recommended to show deep structures. These data should be provided as annotated maps and as Plain Text (ASCII) XYZ-files.

3. Definitions and Idealised Survey and Data Parameters

- **High Resolution MCS** data, which theoretically should allow for a detectable limit of layers approximately 6 m in thickness:

Parameter	Value
Optimum sampling rate (SR)	1 ms (up to 2 ms)
Shot interval	≤ 25 m
Streamer length	≥ 1200 m
Fold	~50
CDP interval	≤ 25 m
True amplitude preservation	Yes

- **Middle Resolution MCS** data, which theoretically should allow for a detectable limit of layers approximately between 6 and 15 m in thickness:

Parameter	Value
Optimum sampling rate (SR)	2 ms
Shot interval	25-50 m
Streamer length	≥ 2000 m
Fold	50-100
CDP interval	25-50 m
True amplitude preservation	Yes

- **2D grid MCS** has a maximum line spacing of 10 km.
- **3D grid MCS** is made up of a dense 2D grid with 1 km line spacings in general, but those line spacings should be determined on a case-by-case basis.
- **3D Seismic Volumes** are extremely dense 3D grids that fill a box-shaped area, sorted into “bins,” and migrated with 3D migration techniques. These seismic techniques are required only in special cases, for example, when proposing to drill small targets and for deep targets with complicated structures.
- **Crossing Seismic Lines** cross each other at roughly 90° and extend at least 10 km beyond the proposed drill site in all directions.
- **SCS Data** are considered on a case-by-case basis; for example, if the proposed drill sites are located in ice covered areas where MCS data collection is difficult, if target depths are very shallow (<100 mbsf), or if simple volcanic structures (such as seamounts and submarine plateaus) are targets. In these cases, the determining factor is whether or not the data adequately image the targets.
- **High-resolution sub-bottom acoustic (seismic) profiling data** are acquired using 3.5 kHz, CHIRP, Parasound Topas, or similar systems that image the stratigraphy of the shallow section (<100 mbsf) with a theoretical resolution of < 1 m.

4. Examples of Data Needs

This section provides example data sets for typical IODP³ expeditions linked to the “2050 Science Framework” strategic objectives. Actual requirements and needs, however, vary according to specific proposal objectives and drilling/coring targets.

4.1. Habitability and Life on Earth; Earth’s Climate System; Tipping Points in Earth’s History

IODP Expedition 318 Wilkes Land

IODP Expedition 339 Mediterranean Outflow

IODP Expedition 342 Paleogene Newfoundland Sediment Drifts

IODP Expedition 331 Deep Hot Biosphere

IODP Expedition 336 Mid Atlantic Ridge Flank

IODP Expedition 337 Deep Shimokita Coalbed

- High resolution MCS (or SCS where target depth is <100 mbsf).
- For complex targets 2D or 3D grids of MCS data are required.
- Sites ideally should be located on or near crossing lines, depending upon demonstrated regional continuity of reflections.

- Acoustic backscatter data (side scan or multibeam) to characterise the seafloor.
- Swath or multibeam bathymetry data. Necessary resolution depends on seafloor characteristics.
- Seismic velocities appropriate to demonstrate the local velocity fields.
- High-resolution subbottom acoustic profiling data.
- If available, surface samples (data reports, figures, tables) to provide information on surface sedimentary composition and structure. Locations to be shown on maps.
- If available, video/photography if drilling into a hard and/or irregular outcrop such as a reef or a basalt outcrop.

4.2. The Oceanic Life Cycle of Tectonic Plates; Feedbacks in the Earth System

IODP Expedition 331 Deep Hot Biosphere

IODP Expedition 340T Atlantis Massif

- Middle resolution MCS.
- For complex targets 2D or 3D MCS grids or 3D seismic volumes, particularly in cases involving fluid and volatile flow.
- Sites ideally should be located on or near crossing lines.
- Acoustic backscatter data (side scan or multibeam) to characterise the seafloor.
- Swath or multibeam bathymetry data. Ideally 10 m pixel size.
- If available, refraction seismic data and structural modelling for deeper targets that MCS data (with interpretation) cannot properly image.
- Seismic velocities, both for reflection (appropriate to demonstrate the local velocity fields) and, if available, for refraction data.
- High-resolution sub-bottom acoustic profiling data where a thin sediment veneer overlies crystalline basement.
- If available, surface samples (data reports, figures, tables) to provide information on surface sedimentary composition and structure. Locations to be shown on maps.
- If available, video/photography if drilling into a hard and/or irregular outcrop such as a reef or a basalt outcrop.
- Gravity and magnetic data for deeper targets.

4.3. Global Cycles of Energy and Matter; Natural Hazards impacting Society

IODP Expedition 340 Lesser Antilles Volcanism and Landslides

IODP Expedition 343 Japan Trench Fast Earthquake Drilling Project (JFAST)

- High or middle resolution MCS, depending on the target.
- For complex targets 2D or 3D MCS grids or 3D seismic volumes, in particular in cases involving gas hydrates, fluid flow and deeper complicated structures.
- Sites ideally located on or at least near crossing lines.
- Acoustic backscatter data (side scan or multibeam) to characterise seafloor in the case of, for example, fluid flow, landslide, or rugged terrain.
- Seismic velocities, both for reflection (appropriate to demonstrate the local velocity fields) and, if available, for refraction data.
- High-resolution sub-bottom acoustic profiling data where a thin sediment veneer overlies crystalline basement.
- Swath or multibeam bathymetry data. Ideally 10 m pixel size.
- Refraction data and structural models to accurately image deeper targets, such as fault zones and slip planes.

- Gravity and magnetic data for deeper targets.

5. Recommended Data Formats

It is strongly recommended that proponents adhere to the following formats when submitting data. This ensures that data can be widely accessed by reviewers and panellists. The SCDB allows additional data formats, but recommends that these only be used if there is a compelling reason, and by prior agreement with IODP³-SO Proposals and Meetings Manager.

All georeferencing, inside files and in the metadata, should be in decimal degrees using WGS 84 referencing system.

Data Type	Recommended Data Format
Digital Seismic	SEGY with byte locations and EBSDIC header information
Echosounder or subbottom profiler	SEGY with byte locations and EBSDIC header information, KEB
Images (Graphics)	JPEG, TIFF, PDF, PNG
Documents	PDF, Plain Text (ASCII)
Tables	PDF, Plain Text (ASCII)
Video	MPEG, Quicktime movie (MOV)
Digital Maps	NetCDF (GMT) GRD, Fledermaus SD or Scene
Logging Data	LAS, Plain Text (ASCII), in delimited columns
Navigation	Plain Text (ASCII), in delimited columns, UKOOA (data in decimal degrees)
Velocity	Plain Text (ASCII), in delimited columns and semblance plots (JPEG or PDF)

6. Appendix: Metadata

A set of metadata is requested with each uploaded file in SCDB.

6.1. General Metadata (applies to all data types)

Metadata Field	Description
Site Names	The drill site(s) to which the file relates
Type	Is the file data, map, photo/video, or document/other
Format	e.g., plain text, PDF, SEGY
Data Owner	Who created/has intellectual ownership? Must include a given and family name, and ideally an institution. Only ASCII characters allowed; no symbols/diacritics.
Description	Must include all additional information needed to understand the file. Up to 4000 characters, ASCII only, no symbols/diacritics.
Access Control	Do you need to place a proprietary hold on this file, or is it available for public release? If the data requires a Non-Disclosure Agreement, contact us before uploading the data.
Reason for Hold	If a Hold is requested, a justification must be provided
Start Time	When did the data collection period begin (leave as default if unknown)
End Time	When did the data collection period end (leave as default if unknown)
Georeferencing	The latitude/longitude bounds of the file, in decimal degrees (-90 to 90 latitude, -180 to 180 longitude) and WGS 84 referencing system. Georeferencing must match the file (e.g., most SEGY files should use a line, maps should use a bounding box).
Related Activity	IODP ³ Proposal number, Expedition number, Drill Hole, or Cruise name of any related activity
Method	The method through which the data were collected. This will be a drop-down list that varies by data type.
Archive DOI/Persistent URL	If the file is archived in a recognized data repository, please provide the DOI, a persistent URL, or other globally unique identifier.

6.2. Additional Metadata for SEGY files

Metadata Field	Description
Seismic Line Name	The name or identifier of the seismic line
UTM Zone	UTM Zone, if SEGY is georeferenced in UTM (e.g., 31J)
Horizontal Units	e.g., CDP, Shot Point
Vertical Units	e.g., two-way travel time, metres
doi	Doi for the published seismic data file; this should be used when the data is downloaded for purposes other than proposal reviewing