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Guidelines for Site Characterization Data

IODP Science Evaluation Panel

IODP
INTERNATIONAL OCEAN DISCOVERY PROGRAM

The JOIDES Resolution Facility Board approved these guidelines on May 18, 2016

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IODP Science Evaluation Panel (SEP): Guidelines for Site Characterization Data

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

This document outlines data requirements and recommendations for proposals undergoing review by the Science Evaluation Panel (SEP). In addition to evaluating the science of a proposal (see *Proposal Submission Guidelines,* available from the Program Documents section on www.iodp.org), the SEP reviews all site characterization data submitted by proponents to the IODP Site Survey Data Bank (SSDB) at http://ssdb.iodp.org. This ensures the highest probability of achieving the scientific objectives of a drilling 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 characterization data and a carefully worked out drilling strategy. Site characterization data requirements will vary according to objectives, but should demonstrate that the proposed sites are correctly positioned, and that the drill targets are adequately imaged and lack structural complications. Every proponent team should include a proponent who has the ability to manipulate and interpret geophysical data, and who can prepare statements, maps, and diagrams addressing the adequacy of the data. Submitting additional data *beyond* what is necessary for adequate site review does *not* improve a proposal's chance of success, it may place a burden on the review system.

Following each review, the SEP advises the proponents in a review report emailed by the Science Support Office (SSO) whether or not the site characterization data uploaded and available in the SSDB are adequate for these purposes, which data are missing, and what issues remain to be addressed.

Proponents should carefully read the following sections. **Chapter 2** provides general data guidelines. **Chapter 3** provides definitions and a list of idealized site survey and data parameters to guide collection of site characterization data. **Chapter 4** provides example data sets for typical IODP expeditions organized by research theme. **Chapter 5** provides a list of recommended formats for different data types. Following these guidelines will help ensure that proposals move through the SEP review process most efficiently and without

unnecessary delays. Questions regarding data submission should be directed to the Science Support Office (science@iodp.org) or to the SSDB team (http://ssdb.iodp.org/contact.php).

Chapter 2 Data Guidelines & File Formats

The following summarizes data that are fundamental to nearly every proposal. Both SEP and the SSO enforce these guidelines and may contact proponents to ensure adherence. Definitions are given in Chapter 3 and recommended file formats in Chapter 5.

(1) Required Digital Seismic Data

- **Single-Channel Seismic (SCS)** or **Multi-Channel Seismic (MCS)** reflection data in SEGY format with the following header information. Note that if the header location does *not* follow the SEGY standard as shown below, proponents must provide a similar table in a separate document describing the location of all headers in their SEGY 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
(for MCS) Navigation coordinate (y) for CDP	185-188

TIP: If uploading the header information table as a separate document in SSDB, upload it using Data Type *Document*. If it is associated with just one SEGY file, then name the file so that the relationship is clear (e.g. line334.segy and line334_segy_headers.pdf). If multiple SEGY files share the same header information document, then use the *Description* field in the SSDB metadata for the SEGY file to identify the associated header information file.

- **Acquisition** and **Processing Parameters** should be provided in a document 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 stage, type filter flanks, type of gain)	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

SSDB tip: As with the header location data, upload the Acquisition and Processing Parameters as Data Type *Document* in SSDB and use either the filename or the *Description* field to indicate which SEGY files are associated with this parameters file (e.g. line334_acquistion_processing_parameters.pdf).

- **Velocity Data** (collected and/or modeled) 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 organized by CDP. In addition, images showing (5) color-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.

SSDB tip: Seismic figures should be uploaded into the Data Type that matches their acquisition source. For example, an image from MCS data should be uploaded as Data Type *Seismic Multi Channel* in SSDBupload Step 1 and Type *Profile Image* should be selected in SSDBupload Step 2.

- **Navigational 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.

SSDB tip: It is critical that the SP or CDP number and associated geographic coordinates in *decimal degrees* 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; similar file naming (e.g. line64.segy and line64.nav) or the *Description* field in the SEGY file's metadata should be used to make the association clear.

(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) color-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.

(3) Other Data (may be requested by 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 characterize the seafloor. These data may be provided as high resolution image files or any of the formats listed for digital maps (Chapter 5).
- **Subbottom Acoustic Profiler** data (called Seismic Subbottom Profiler Data in SSDBupload) to characterize 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 both as image files and as SEGY files, in a similar fashion as MCS and SCS data.

- **Seafloor Imagery** is recommended if drilling into a hard irregular outcrop, such as a reef or a basalt outcrop. These data should 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.

Chapter 3 Definitions and Idealized 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 will be 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** will be 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 oceanic 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.

Chapter 4 Examples of Data Needs

This Chapter provides example data sets for typical IODP expeditions organized by IODP Science Plan research themes. Actual requirements and needs, however, vary according to specific proposal objectives and drilling targets.

(1) Climate and Ocean Change & Biosphere Frontiers

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 characterize 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.

(2) Earth Connections

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, in particular 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 characterize the seafloor.
- Swath or multibeam bathymetry data. Ideally 10 m pixel size.
- If available, refraction seismic data and structural modeling 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.

(3) Earth in Motion

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 characterize seafloor in the case of, for example, fluid flow, landslide, or rugged terrain.
- 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.

Chapter 5 Recommended Data Formats

It is strongly recommended that proponents adhere to the following formats when submitting data. This will ensure that data can be widely accessed by reviewers and panelists. The SSDB allows additional data formats, but we recommend that these only be used if there is a compelling reason, and with advance contact with SSDB staff.

Digital Seismic	SEG-Y with byte locations and EBSDIC header information
Echosounder or subbottom profiler	SEG-Y with byte locations and EBSDIC header information, KEB
Images (Graphics)	JPEG, TIFF, PDF, Portable Network Graphic (PNG)
Documents	PDF, Plain Text (ASCII), RTF
Tables	PDF, Plain Text (ASCII), RTF
Video	MPEG, Quicktime movie (MOV)
Digital Maps	NetCDF (GMT) GRD, Fledermaus SD or Scene
Logging Data	LAS, LIS, 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)