

## GENERAL SPECIFICATION

### SURVEYS

#### GS EP GEO 206

**Seabed Sampling for geochemical, heat flow and  
biostratigraphic analysis - SGE**

|      |         |                                    |
|------|---------|------------------------------------|
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| General Specification                                                          |                         | GS EP GEO 206 |
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## 1. Scope

The purpose of this document is to detail the Company minimum requirements for performing a **Shallow Geochemical Exploration campaign (SGE)**, heat flow and biostratigraphic analysis.

## 2. Reference documents

The reference documents listed below form an integral part of this General Specification.

### External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

| Reference      | Title |
|----------------|-------|
| Not applicable |       |

### Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

| Reference     | Title                                                     |
|---------------|-----------------------------------------------------------|
| GS EP GEO 101 | Offshore Geotechnical Survey                              |
| GS EP GEO 110 | Requirements for Offshore Survey Vessels                  |
| GS EP GEO 201 | Offshore Geophysical Site Investigation                   |
| GS EP GEO 401 | GIS requirements for engineering site surveys and studies |
| GS EP POS 001 | Offshore surface positioning works                        |
| GS EP POS 002 | Subsea positioning works                                  |

## 3. General

The contents of these General Technical Specifications indicate the minimum standards required by Company. However, if Company considers that any aspects of the service Work requires more detailed investigation, Company reserves the right to apply further Particular Technical Specifications.

All Equipment and Materials necessary to complete the survey in accordance with this Contract shall be supplied by Contractor. Such Equipment and Materials shall include all spare parts and spare Equipment units as may be necessary to provide normal and continuous operations, and shall be in good operating condition prior to the award of Contract.

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Such Equipment shall be properly maintained in such a way as to assure accuracy within the tolerances set by the manufacturers for such Equipment. Contractor undertakes to provide a statement of the surveying accuracy of this Equipment.

The Work defined in these Specifications shall be performed in accordance with the Agreement.

The Work shall include the following phases:

- **Initial phase - geophysical survey:** In order to identify and select coring targets, a geophysical pre-survey shall be conducted with multibeam echo-sounder (MBES - bathymetry, backscatter and Water Column Imaging (WCI) data), and sub-bottom profiling (single-trace pinger, boomer/sparker); followed by on-board processing, interpretation and charting of these data for high-quality preliminary results.

If available, Company may consider to select sampling locations based on seabed amplitude maps and seabed dip maps extracted from the 3D exploration dataset. In this case, 3D bathymetry and amplitude maps and preliminary coring locations will be provided to Contractor. If Company agrees to provide the 3D dataset during the offshore work, Contractor shall have the capacity to visualise the dataset with adapted workstation (SMT or similar).

- **Follow-on phase - coring/sampling:** seabed coring and sampling, implementing piston drop coring, geochemical and/or biostratigraphic sub-sampling, and heat flow measurements.
- **Onshore phase - analysis:** data and samples, properly conditioned, sent to agreed reporting office or laboratory analysis facility respectively. Preparation of comprehensive Reports in English language integrating all acquired data and analyses.

The final product shall be an expert report.

The programme of the Work is described in Exhibit A2 "Particular Technical Specifications".

## 4. Vessel used by Contractor

The vessel to be used by Contractor will be a survey vessel for work to be performed in open sea, as defined in Company General Specifications **GS EP GEO 201** and **GS EP GEO 110**.

In addition, for the type work, particular consideration shall be taken in respect of:

- **Vessel station-keeping** - Dynamic Positioning (DP1 as a minimum) is considered imperative for the 1-3 hours needed by each corer or Heat Flow probe deployment.
- **Deployments** - Dedicated equipments are called for, particularly for deep-water deployments (down to 3000 m WD). Winch performance with 100 m/min is considered a minimum. The safety of the operation should address including crane plan, vessel stability and Safe Working Loads (SWL). Wires and fastenings (blocks, booms, davits) should be certified at vessel mobilisation.
- **Sample processing and storage** - Geochemical sampling puts stringent requirements on a spacious and clean sample processing area, and reliable freezer amenity for sample storage; this extends to cold-chain freight of samples from vessel to onshore laboratory for analysis.

## 5. Work specifications

### 5.1 Geophysical pre-survey

If required (no 3D dataset available), a geophysical pre-survey must be carried out prior to the seabed sampling survey in order to define the coring locations. This geophysical pre-survey must be performed with Single-Beam Echo-Sounder (SBES), Multi Beam Echo-Sounder (MBES), and Sub-Bottom Profiler (SBP) according to Company General Specification **GS EP POS 001**, **GS EP GEO 201**.

Results of the geophysical pre-survey shall be properly interpreted during the survey. All results from SBES/MBES (bathymetry/backscatter/WCI) and SBP shall be integrated to allow identification of potential seabed seepages. All data shall be integrated in a GIS according to **GS EP GEO 401**. By the end of the geophysical pre-survey, Contractor shall propose a documented coring target listing, to be approved by Company Representative.

MBES data shall be interpreted in order to identify particular seabed geomorphologies (pockmarks, mud volcanoes, faults...) from the processed DTM and particular seabed lithologies (carbonates, outcrops, bacterial mats...) from backscatter data. Interpretation results shall be gathered on board in one geographical information system (GIS). GIS requirements are in **GS EP GEO 401**.

WCI allows identification of potential gas plumes in the water column and seepage locations. It must be noted that WCI produces a huge quantity of data, so that acquisition, processing and data storage shall be sufficient to handle such dataset. Water Column Imaging results shall be visualised using relevant software, such as Fledermaus Midwater, CARIS ver.8+ or equivalent. Displays can be viewed in either a fan view, one beam at a time viewing along the axis of the survey line, or in "stacked" view. The stacked view allows the user to view the entire length of the line perpendicular to the survey direction, with all beams collapsed into one plane. In this way, the line can be rapidly assessed for the presence of plumes or other features in the water column.

### 5.2 Seabed Sampling

#### 5.2.1 General

Actual core locations identified during the geophysical pre-survey and validated by Company's Representative will be sampled in prioritised order, and may be updated as fieldwork progresses, depending on findings.

At request from Company Representative, selected target locations may be confirmed on given sites by the acquisition of short lines (hundreds of meters long) using MBES and SBP, and passing over the target. This acquisition shall be used to confirm and fine-tune the expected coring/sampling location.

A Kullenberg-type piston corer shall be deployed to achieve the recovery of the sea-bed samples. The internal diameter of the corer shall be not less than 0.10 meter, with transparent liners. The length of the barrels shall be at least 6 meters.

In order to obtain required positioning accuracy and resolution of the seabed samples, with regards to geophysical pre-survey results, the coring system must be positioned. Contractor's

positioning system (USBL) and procedure shall comply with Company General Specification **GS EP POS 002**.

## 5.2.2 Geotechnical sampling

If required, the geotechnical coring procedure and the geotechnical tests to carry out shall comply with Company General Specification **GS EP GEO 101** and **GS EP GEO 201**.

## 5.2.3 Geochemical sampling

### 5.2.3.1 Sampling procedure

The sampling procedure starts once the core barrel is secured on board and the liner extracted. For this, proper core cutter and splitter shall be made available. A visual description of the whole core (every 20 cm) shall include detection of oil components using UV light and CaCo<sub>3</sub> using HCL acid. Core log should be produced and include scaled photographs with a published colour chart.

A clean and dedicated shipboard laboratory van must be used to collect samples in a hydrocarbon-free environment.

A systematic sub-sampling scheme is based on three (3) samples taken per core, regardless of the total core length. The sub-sampling scheme is as follows: first sample one meter below the top, second in the middle and third at the base of the core (Figure 1).

Each sample will be a full core section, 20 cm long, which will be split into four sub-samples. Two of these will be conditioned in two 'Ziplock' bags, the two others will be conditioned in two cans (Figure 2).

One sample in a 'Ziplock' bag and one sample in a can will be kept as back-ups. After core liner removal, every effort should be made to minimize the time between core retrieval, sample cutting and storage at -20°C. The cans should be poisoned with a bactericide solution, and purged with nitrogen before sealing. All samples are stored in a -20°C freezer until analysis.

Based on the Particular Specification (number of cores), sufficient 'Ziplock' bags and cans must be embarked (double sampling for back-up). The samples intended for lab analysis, and the second back-up set, shall be properly labelled, listed, and kept separately in different freezers (or compartments), prior to shipping.

**Figure 1 - Three sections (light green) shall be sampled for geochemistry**

