

APPENDIX 1 - WATER COLUMN AND SEDIMENTARY ENVIRONMENT

1.7 Cruise Report: Core Sampling MV *Snowgoose*

ENVIRONMENTAL VERIFICATION

CRUISE REPORT

CORE SAMPLING

Prepared for:

Namibian Marine Phosphate (Pty) Ltd.

Prepared by:

Benjamin Bothma

8 - 11 August 2013

Benjamin Bothma

PO Box 754, Lüderitz, NAMIBIA

Phone: +264 63 203 884 Facsimile: +264 63 203 878

Cell: +264 (0)81 128 7826

Email: benb@mweb.com.na

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Email: info@namphos.com
127 Theo-Ben Gurirab Street
Walvis Bay
Namibia

ML 170
PHOSPHATE CORE SAMPLING PROGRAMME
CRUISE REPORT

for:

NAMIBIAN MARINE PHOSPHATE (PTY) LTD

VESSEL: MV *Snowgoose*
CONTRACTOR: Carpe Diem cc
OWNER/CAPTAIN: Lukas Els
CONTACT: +264 63 203358
 crpediem@mweb.com.na
CLIENT: Namibian Marine Phosphate (Pty) Ltd
 127 Theo-Ben Gurirab Street,
 Walvis Bay, Namibia.
 +27 21 7150372
 +264 64 278 150
CLIENT REPRESENTATIVE: Benjamin Bothma
 +264 63 203884
 +264 81128 7826
 benb@mweb.com.na
DATES: 8th to 11th August 2013

OBJECTIVE

To:

- Collect 26 cores in ML 170, SP-1 area, intended for laboratory analysis at the CSIR, Stellenbosch.
- Obtain accurately positioned samples with QC /QA full integrity.

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1 INTRODUCTION

Sampling Cruise # 28 was undertaken to obtain and freeze 26 gravity core samples from ML 170 as part of the environmental verification assessment. The samples were required to be collected in a contamination free manner and with the cores cooled and kept frozen to -18 deg °C from time of collection and during delivery to CSIR, Stellenbosch, South Africa.

2 HISTORICAL BACKGROUND

Phosphatic nodules were first recovered off the Agulhas Bank, South Africa in 1891. In 1978 Dr M. Bremner, of the Marine Geoscience Unit at the University of Cape Town completed his PhD thesis on "*Sediments on the continental margin of South West Africa between Sylvia Hill and the Kunene River.*", for which a regional set of grab and core samples were collected along the coastal waters of Namibia. Since then there has been a steady stream of research on the marine sediments on the Namibian continental shelf including the research cruises of the R V *Benguela* and the R V *Professor Logachev*. In 1992 and 1994 Gencor drilled 50 vibrocorer holes, mainly in EPL 3414 and 3415 and at waters depths of between 200 and 300 m though some holes did stray into EPL 3323. Though data only exists for 38 of these holes, the results were very encouraging with grades between 15 and 22% P₂O₅ and thicknesses in 8 holes in EPL 3414 lying between 2.62 and 5.05 m, Peripheral areas displayed thicknesses of between 1 and 2.0 m. However, bulk sampling in 2004 by the Ocean Phosphate Consortium in EPL 3415 demonstrated the local continuity of grade and thickness in an area where grades lay between 16.66 and 18.35% P₂O₅ and thicknesses between 3.1 and 6.36 m. The above results provided sufficient evidence to support the view that the Sandpiper Project Area (ML 170) could host significant quantities of phosphate, a view that was later confirmed by the 2008 to 2013 grab and core sampling programmes (Cruise Reports 1 to 27).

3 SAMPLING VESSEL

The MV *Snowgoose*, an 18.83 m wooden vessel with a gross tonnage of 63.63 tonnes owned by Carpe Diem Namibia cc. based in Lüderitz, was again used as a platform for the sampling program. The crew consisted of 12 people including the skipper/owner Lukas Els.

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Figure 1: Sampling vessel: MV *Snowgoose*.

4 SAMPLING EQUIPMENT

The third generation 600 kg gravity corer was taken on this cruise (No. 28). Additional weights were also carried to bring the corer weight up to 750kg if required. The gravity corer comprises a spooling head section and attached to the head section is a 3m or 4m long steel pipe section that carries a 3 m or 4 m long 75 mm or 90 mm internal diameter plastic sample tube. On this cruise a 100mm steel pipe and 90mm core tube setup was used for the 26 environmental cores. The 75 mm tube provides about 6.3 kg of material per meter of core while the 90 mm tube provides about 9.2 kg per meter. The 75 mm core tubes are fitted with one-shot aluminium can core catchers riveted and glued in. For the 90mm tubes core catchers are made from clean oil cans which have slightly thicker sheet metal.



Figure 2: Third generation gravity corer in use.

5 SAMPLING METHOD

5.1 GRAVITY CORER DEPLOYMENT

The gravity corer is deployed using the vessel's main winch. This winch is not a free fall winch. The gravity corer works with a lever controlled mechanical braking system. A 50 kg weight on a 5 m cable keeps the brake in a locked position while the gravity corer is lowered towards the sea bed on the main winch cable (16 mm). When the 50 kg weight reaches the sea bed the weight on the lever goes slack, releasing the lever, which allows the brakes to release. The gravity corer then takes a controlled drop of up to 5 m to the seabed on a built-in 13 mm wire spool that sits at the top of the corer.

The GPS position of each gravity core is recorded when it lands on the seabed on two independent GPS units.

5.2 RECOVERED GRAVITY CORE SAMPLES

The core tube is unbolted and pulled free from the steel core barrel. The depth of the core penetration into the sediment is determined from the mud line on the outer core barrel. A retaining cap is immediately put on the catcher end and the extent of the core fill is determined by inserting a wooden pole into the inner tube to tag the top of the sediment and the internal length of core recovered is recorded. A hacksaw is used to cut the inner tube to the length of core fill so that the other retaining cap can be put on. It may need two cuts to get to a snug fit with the top of the sediment.

The sequential sample number is marked on the end cap of the core with a permanent marker and a corresponding sample tag goes inside the core. Samples are labeled with a sequential 4-digit number, which is logged with the temporal, positional, penetration and license information on the master logging sheet. The top and bottom of the core is marked.

6 SAMPLES

In total 26 core sites were attempted in which 25 gravity cores (in the number range 2875 to 2899) were recovered using the 90 mm core barrels, ranging in length from 0.60 to 2.90 m. The final site (2900, SP1GC21), at a water depth of 183 m, only produced enough material on the third attempt to make up a bottle sample. The ML 170 cores were frozen and taken to Lüderitz for onwards transport in two deep freezers to Stellenbosch for environmental analysis.

| Licence | Numbers | Water depth min | Max | Cores |
|---------|-------------|-----------------|-----|-------|
| ML 170 | 2875 - 2900 | 181 | 237 | 25 |

7 POSITIONING

Positioning and depth was recorded by means of a Furuno Navigation system combining a PS-8000 GPS, video echo-sounder and chart plotter. The positioning system is checked both before and after the cruise at a fixed reference point in Lüderitz harbour (the end of the Ministry of Fisheries and Marine Resources jetty). A separate Garmin GPS linked up to the Maxsea Marine Software program was also used to confirm the accuracy of the main GPS on all samples and at the reference point.

The latitude and longitude positions of all planned sample sites were uploaded onto the Maxsea system and the vessel then occupied each site following the simplest cruise pattern. Once on the target position the gravity corer is lowered over the side and the actual position recorded when the corer hits the seabed. This is to account for any drifting of the vessel after the corer was deployed over the side. Each sample is recorded with a sequential number starting at 2875 and ending on 2900, along with coordinate information, sample size and other pertinent information. Data were hand recorded on pre prepared work sheets and then entered into a database after the cruise. Failed core sites were also recorded.

7.1 SAMPLE HANDLING AND STORAGE

The environmental cores are cut to length (halved), capped at either end of each marked up section, then stored flat in a deep freezer. Once in port the diamond inspector inspected the cores before being released for storage. They were then transported to the Carpe Diem premises for temporary storage in the two freezers before onward transport to the CSIR in Stellenbosch. During road transport the cores are kept cold in their freezers which are carried on a trailer and kept working using a generator on the tow vehicle. Temperature gauges (TidBits) are installed in each of the freezer units, which allows for monitoring of the freezer temperatures during transportation.

7.2 CRUISE SUMMARY

The vessel left Lüderitz at 14:30 on Thursday 8th of August 2013 and set sail north to the northern end of ML 170 with a strong SW wind (30 to 35 knots) and a 4 m swell. The vessel arrived at the concession at 07:00 on Friday 9th of August with a 20 knot SW wind and 3.5 m swell. The vessel had to wait for the next few hours for weather conditions to improve. Sampling started at 15:00 with a 15 knot SW wind and 3 m swell. By 18:28 the 6th site had been completed, but the wind had picked up to 18 knots and sampling was stopped pending a forecast drop in wind speed for the following morning. At 03:41 on Saturday 10th August sampling resumed with improved weather conditions (5 knot SW wind). Penetration was generally good although evidence of footwall clay was only present on one of the 26 core samples. The deeper water samples were not expected to reach clay (footwall), while the shallower samples, at water depths of less than 212 m, were in an area where the shell density makes penetration beyond 1 m difficult. Multiple attempts were made where necessary to obtain the optimal penetration. Three of the short cores taken during poorer weather were repeated in better conditions at the end cruise with much better results (Waypoints 12, 20 and 25). Waypoint 21 failed to retain much material from any penetration with 3 attempts and the limited material obtained was put in a plastic bottle. At 17:30 on 10th August sampling was completed and the vessel sailed back to Lüderitz arriving at 12:00 on Sunday the 11th August where cores and freezer were unloaded and stored at the workshop.

8 QC PROCEDURES SUMMARY

The client representative,

- Verified the effectiveness of the GPS positioning system (by comparison with an independent GPS and reference to a fixed position);
- The quality of samples collected (by observation);
- The reliability of the record keeping (records attached and each page signed off);
- Correct labeling of the samples;
- Good storage of samples (no leakage, and careful handling of samples).

8.1 RECOMMENDATIONS

For environmental sampling freezer capacity limits the number of cores that can be taken per freezer load. An extra freezer may be necessary.

Annexure 1: Location map ML 170 – Waypoints / Core sample sites

