DGT2017 6-8 September 2017 Gold Coast, Australia
SESSION: DGT for routine monitoring and regulatory purposes

DEVELOPMENT AND USE OF AN AUTOMATIC SEQUENTIAL PASSIVE SAMPLER FOR THE MONITORING OF DISSOLVED METALS IN MARINE ENVIRONMENTS

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REGULATORY CONTEXT

Extensive nickel mining in New Caledonia

- 4th largest Nickel reserves (6.7 million MT, 2016)
- 5th largest Nickel producer (205 000 MT, 2016)

3 large Nickel plants in New Caledonia and numerous mining extraction sites, **the majority of them juxtaposed to the coastline.**

Classified as a UNESCO world heritage site in 2008

Classification requires: ***'Enhanced surveillance and monitoring are required to address potential impacts from fishing and mining'***


B.Moreton


B.Moreton

REGULATORY MONITORING

Current situation in New Caledonia:

- Spot sampling = **only a single concentration in time**
- Periodicity of monitoring surveys = **3 to 12 months**
- Needs to be improved: Increase sample frequency = **costs increase**

Balance between improving sampling strategy and the cost

Is the solution high frequency manual passive sampling?

- Covers a longer time period smoothing out extreme concentrations
- Deployment still costly when manually immersed/recovered

Boat, driver, divers = >1 500 USD/day
(12 weeks of sampling with DGT units:
~20 000 USD!)

SOLUTION : DEVELOPMENT OF AN AUTOMATIC PASSIVE SAMPLER

OBJECTIVE OF THE SAMPLER: Increase the collection frequency to improve the monitoring by reducing the logistical costs

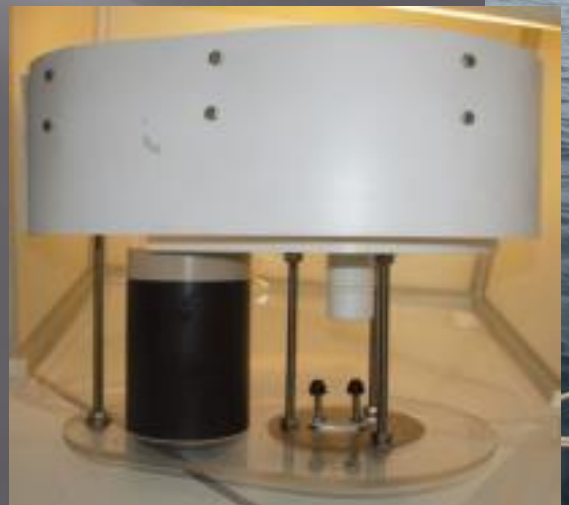
FIRST STEP: feasibility study

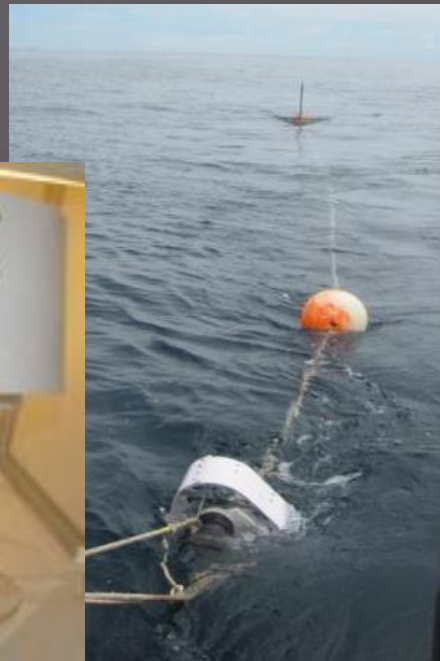
Scientific prototype development: design of a system that exposes and isolates the DGT® devices (DGT-Research) sequentially

INITIAL TESTS:

- Motor and electronics functioning
- Seal isolation efficiency of the DGTs®
- Practical deployment (3 laboratory trials)

Sea trial -10 week immersion period

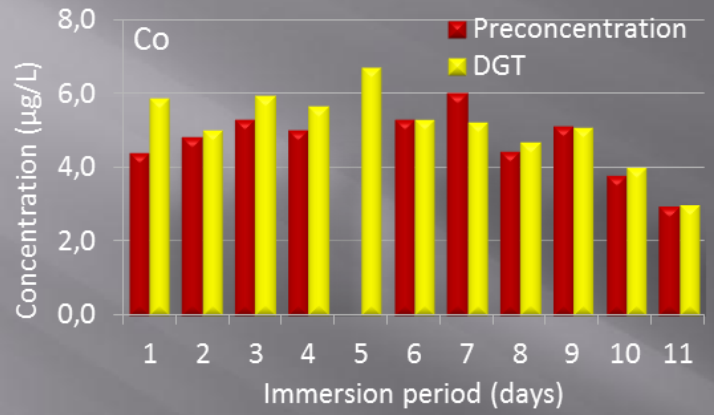




RESULTS FROM FEASIBILITY STUDIES

Test 1

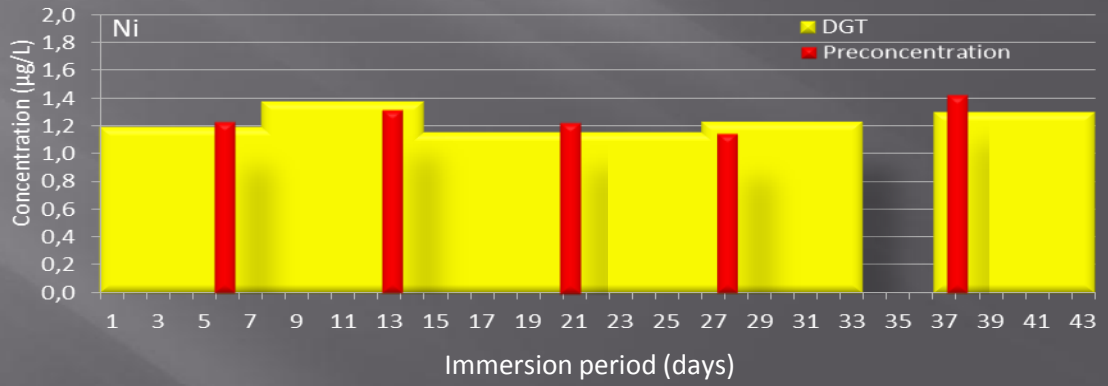
11 Day test with 1 day exposure period



Example for Cobalt and Nickel: good correlations between the 2 techniques, respectively : R^2=0,75 and R^2=0,82

Test 2

40 Day test variable exposure period



RESULTS FROM FEASIBILITY STUDIES

Test 3

Contaminated tank study – Concentration of dissolved metals in the DGT eluate

Sample	Cu (µg/L)	Mn (µg/L)	Ni (µg/L)
DGT blank (6 days isolation) n=3 (LQ ICP-OES)	<2,5	<1	<2,5
DGT_1 (5 days exposure) n=1	4218	31,9	416
DGT_2 (1 day exposure) n=1	857	13,6	93,1

No cross contamination observed in the blank

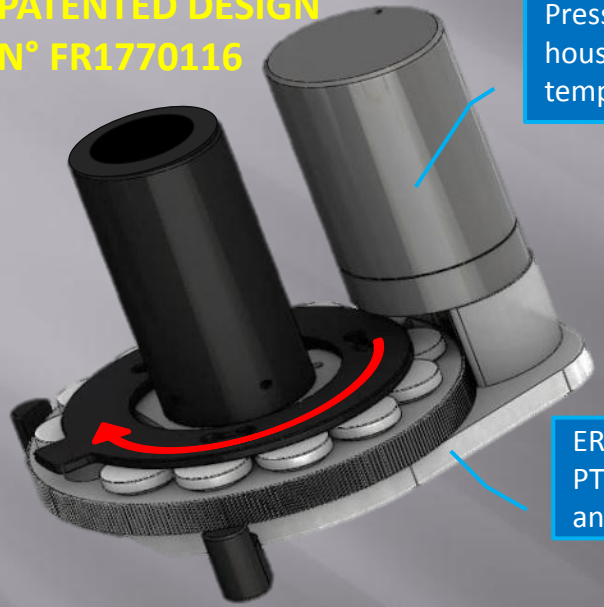
CONCLUSIONS OF THE FEASIBILITY TESTS

- Concept of the system functions effectively
- Spot sampling confirmed metals concentrations determined by DGT® devices installed in the sampler were coherent
- Confirmation of overall feasibility of the project

Next step <u>development of an industrial prototype</u>

INDUSTRIAL PROTOTYPE: MAIN COMPONENTS

PATENTED DESIGN
N° FR1770116



Pressure resistance PEEK/PETP housing containing the motor and temperature logger

ERTHALYTE® base plate with PTFE coated upper section and DGT exposure window

Directional vane

Rigid fiberglass shell

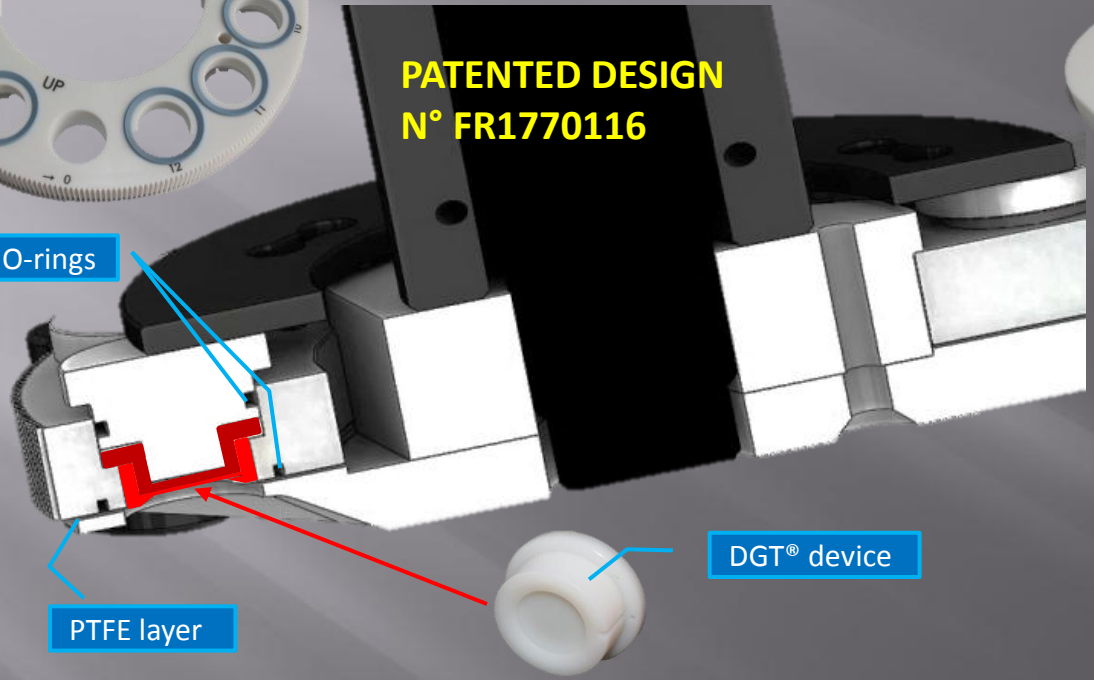
DGT exposure window

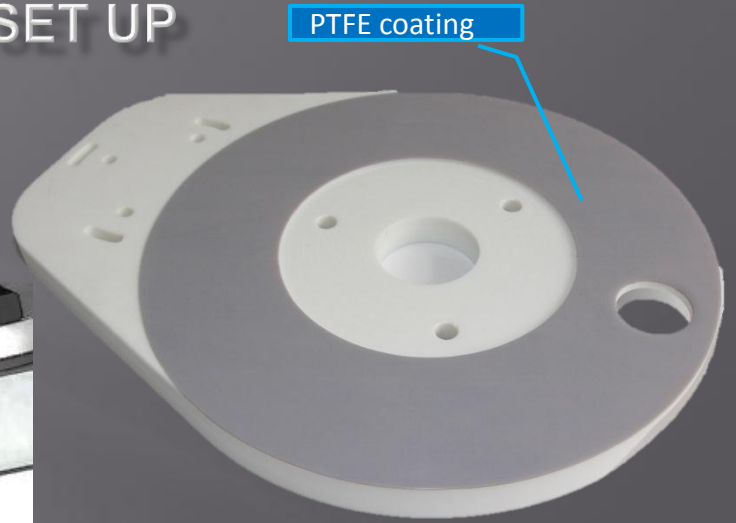
Titanium mooring bar

- New design of the DGT® exposure window for a better contact with water
- Rotational mooring bar and vane added to allow the window to face the current

INDUSTRIAL PROTOTYPE: SET UP

PATENTED DESIGN
N° FR1770116





- DGT® fixed into cavities and sealed with a bung equiped with an o-ring
- Isolated with second O-ring against a PTFE layer

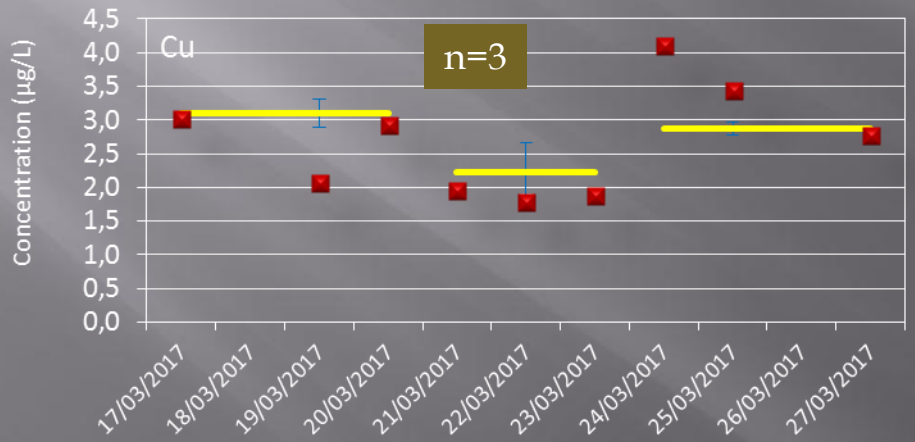
APPLICATION: 1

Preliminary studies: Effect of the biofilm on DGT measurements (POSTER PRESENTATION)

MONITORING NOUMEA HARBOUR (POSTER PRESENTATION)

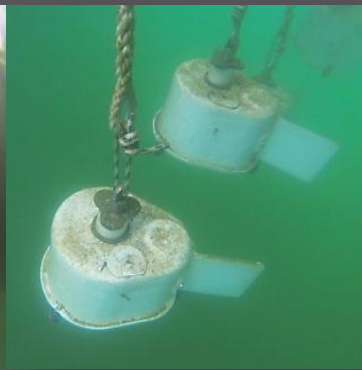
MONITORING CONDITIONS

- Three units placed side by side (triplicate analysis)
- Exposure time per DGT® = 3 days.
- Daily spot sampling (preconcentration)



RESULTS

- Similar concentrations determined using the two techniques
- Minor variations due to tidal effects



APPLICATION: 2

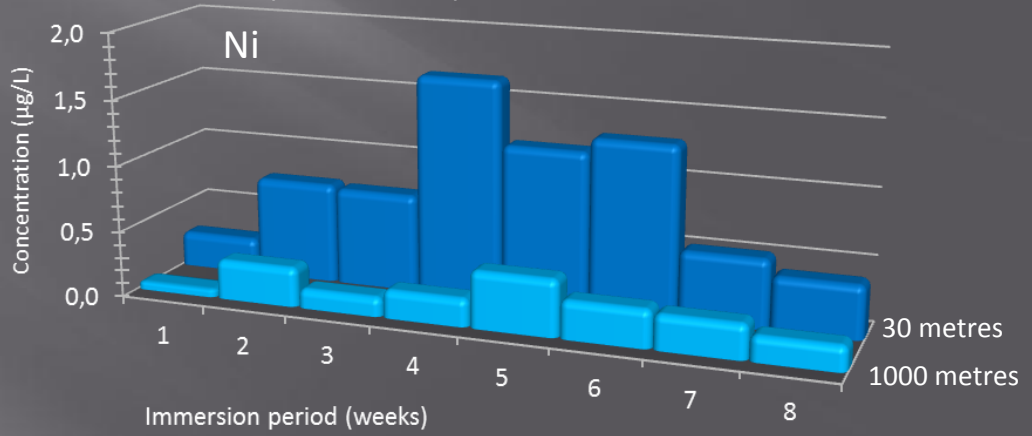
MONITORING A MINING OUTFALL

CLIENT's REQUIREMENT: enhanced monitoring of an effluent outfall

- 5 units deployed for 8 weeks
- Exposure time per DGT® = 7 days.
- Samplers placed either side of effluent diffuser
- (30, 60, 1000 metres) at 35 to 40 m depth.

RESULTS

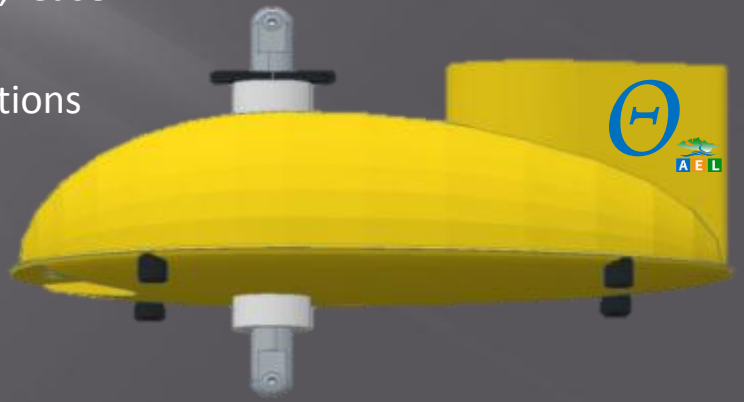
- Observed elevated concentrations in proximity to the diffuser (30 metres)
- Background concentrations (1000 metres)



PERSPECTIVES

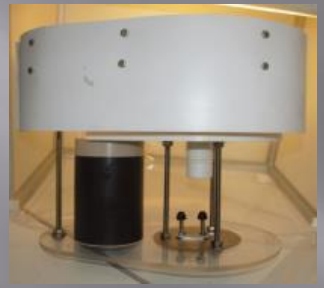
DEVELOPMENT OF A COMMERCIAL MODEL : THOë

- Exposure of triplicate DGT® devices (using the same or different binding layer)
- Optional increase in the number of DGT® devices sequentially exposable (>12)
- Sealed and streamlined housing to limit particles intrusion, ease cleaning.
- Possibility to add internal float for bottom mooring applications
- Improved software interface



2013

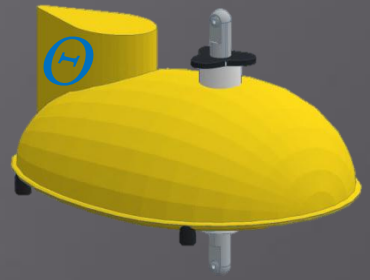
2016



2017

DGT2017
6 - 8 September, Gold Coast, Australia

Fev 2018



Oi oceanology international 2018 13–15 MARCH 2018, LONDON, EXCEL

Thank you for listening

AEL

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