European Innovation Partnership on Raw Materials

Application for a Raw Materials Commitment

“Alternative Blue Advanced Technologies for Research On Seafloor Sulfides” : securing long term raw material supply to Europe by developing and testing deep-sea technologies for exploration and evaluation:

Acronym: ALBATROSS

Links to the Strategic Implementation Plan:

- I. Technology Pillar
  - I.A Priority Area: Raw materials research and innovation coordination
    - Action area n° I.1 Improving R&D&I coordination in the EU
      1) Coordination of industrial initiatives
      2) Coordination of Member States and EU initiatives
    - I.B Priority Area: Technologies for primary and secondary raw materials’ production
      - Action area n° I.2: Exploration
        1) New exploration technologies
      - Action area n° I.3: Innovative extraction of raw materials
        4) Deep-sea mining

Objectives of the commitment:

This project contributes to develop cost-effective technologies to evaluate Seafloor Massive Sulphides deposits (SMS), considered as “the most promising” by Blue Growth, and enables sustainable access to resources in EU States Exclusive Economic Zones (EEZ). Wallis and Futuna EEZ potential was confirmed by large scale mapping in previous campaigns. More biodiversity studies, monitoring, high resolution mapping and developments for seafloor geophysical and water column analysis are required to locate inactive areas. Evaluation requires 3D geometallurgical models. As current drilling tools need long campaigns and do not fit for chaotic seafloor or dispersed ore, development is needed. Sea cruises will give EU a chance to prove the potential of its EEZ and its ability to perform exploration through an integrated tool, perfectly fit for any SMS, based on collaboration.

Description of the activities:
ALBATROSS activities will consist of 5 different phases: specifications, design, manufacturing, offshore campaigns and ore evaluation.

1/ Specification, phase 1, will consist in a review of 3 first campaigns results and the requirements for the whole exploration and evaluation method. A collaboration of all participants is needed for this task.
   • Strategy of exploration and evaluation of deep sea seafloor massive sulfides (SMS) will be the first step and will be updated thanks to the technology proposal of each member.
   • This phase will describe all data necessary to locate inactive deposits, to estimate the thickness of the ore body and to provide all information needed to characterize the deposit vertically.
   • The geological setting (volcanic and tectonic), topography and specificity of the potential areas to be explored will be attentively studied.
   • Objective in terms of quality and cost will be set at this level. A benchmark will be suitable.
   • Particular attention will be paid on environmental requirement to ensure minimum impact during exploration.

2/ During the second phase, the partners will prepare the technical conceptions needed for the exploration and the evaluation of deposits:
   • Water column data processing
   • Development and integration of real-time exploration technique based on electrical plasma
   • Drilling Remotely Operated Vehicle (ROV)
   • Geophysics Acquisition Instrument, ROV or Autonomous Underwater Vehicle (AUV)
   • Environmental Survey and monitoring Systems

3/ Construction of prototype will be carried out during phase 3 for the purpose of the offshore demonstration in Wallis and Futuna.

4/ Phase 4, consists of sea operations during four exploration campaigns in Wallis and Futuna. Campaigns are expected to last between one and a half month.
   • Campaign A, will consist in a high resolution geological cartography of 10 prospective targets in non-active areas with AUV and manned submersibles for systematic sampling, to be analyzed at sea-surface. First tests of the Geophysics Acquisition Instrument could also take place. A preliminary environmental survey will be set up on the seafloor and the water column. Detailed mineralogical, chemical and geotechnical studies will be done on mineralized samples. Chemical studies will be done on hydrothermal fluids and water samples from the hydrothermal plume to quantify natural chemical input in the water column and prepare the impact studies.
   • Campaign B: Near seafloor geophysics acquisition will be performed on around 6 different mineralized zones. Environmental Survey will be reinforced in the most prospective sites.
   • Campaign C and D: drilling will be accomplished in the two to three most prospective deposits. Environmental survey will be reinforced if necessary in the drilled areas. Geophysics complementary acquisition could be necessary to have a good overlap with drillings.

5/ The last phase consists of finalizing geochemical and mineralogical analyses and to correlate drilling results with geophysics result. A geological conceptual model and then a 3D numerical model will be built on one selected site. A technical and economical evaluation of the deposit will be performed. Drilling samples will be used to accomplish preliminary beneficiation tests. These data will be used in the final evaluation of the deposit. Data from the environment survey will be picked up and analyzed one year after the drilling campaigns.

**Description of the expected impacts:**

At the end of the project, EU partners will be able to propose proven and cost-effective technologies
and methodology to explore and evaluate SMS deposits. The services range from regional exploration – through an access to the 3D modeling with drilling & geophysics methods – and environmental survey to recovery, process development and ore deposit evaluation. This project intends to reduce the exploration and evaluation costs for deep-sea deposits and will push Europe to the forefront of technologies and related services in this domain.

Environmental survey and monitoring at an early stage will be a significant step to build a strong baseline necessary to develop an undersea mining operation with minimum impact on natural life. This aspect is integrated in the methodology to provide a comprehensive range of services in accordance with international standard (ie : ISA).

This project and the extraction project being submitted to the call for commitment called SeaFlores aim at demonstrating by a state of the art evaluation the undersea mining potential in a European EEZ. It represents a new step to access to new metal sources not discovered yet.

The technologies improved or developed in this project are essential for Europe to evaluate other deposits in the EEZ of its members but also in international waters. Newly developed methods could be used by authorities to improve Land Use Planning.

The success of such an innovative project relies on an effective and intimate coordination of European-wide industrials and academics skills and resources, along with a good coordination of each initiative. All improvements and collaborations proposed here are a first essential step to deep-sea mining development in Europe.

**Expected innovation outcomes:**
New products to the market
New services
New technologies
New business models
Other

**Comments:**

To date, some marine technologies to explore, evaluate thickness and acquire quality data at depth on SMS exist but are not mature to be used efficiently and cost-effectively by industrials. The project with innovative modifications guided by clients will provide cost-effective technologies adapted to rough disseminated areas and minimize oceanographic ship time.

Environmental aspects will be integrated in the tools design and monitoring will be part of the exploration methodology.

This project will allow EU partners to have a fully integrated tool of deep-sea SMS evaluation based on their collaboration and coordination. Although test will be carried out in Wallis-et-Futuna, this concept will fit in with any SMS deposit both in Europe and abroad.

**Name of the coordinating organisation:**
ERAMET SA

**Country:**
France

**Entity profile:**
Private sector - large company

**Role within the commitment:**

ERAMET, leading entity, will perform the multidisciplinary interfaces management and coordination. After determination of the strategy and specifications, ERAMET will focus on data quality acquisition by fulfilling the best practice standards of ore deposit evaluation.

ERAMET, as for the 3 first campaigns, intends to participate financially to the scientific cruises and will achieve preliminary process studies, 3D mining models and evaluation.
Other partners:

Name of partner:
University of Bremen (UB)
Country:
Germany
Entity profile:
Academia
Role within the commitment:
UB is responsible for design, realization and implementation of a geophysical exploration system with controlled source electromagnetics (CSEM), optical, magnetic and acoustic sensing for ROV and submersible enabling joint detection, volume estimation and environmental assessment of SMS. We will model and specify CSEM sensor, conduct field trials with existing CSEM, and develop and validate methods for data acquisition, processing and analysis.

Name of partner:
IFREMER
Country:
France
Entity profile:
Governmental/public body
Role within the commitment:
Ifremer will coordinate the exploration cruises and the study of active and inactive sulfide deposits. Ifremer will also coordinate the geological, geochemical and ecological studies with existing and arising tools as deep sea AUVs and innovative geophysical payloads. The objective is to build conceptual 3D geological model for each sulfide deposit. Moreover, Ifremer will participate in the design and validation of the EBS protocols.

Name of partner:
TECHNIP FRANCE
Country:
France
Entity profile:
Private sector - large company
Role within the commitment:
TECHNIP participated as a financial contributor to the 2010, 2011 and 2012 explorations campaigns led by Eramet and Ifremer offshore Wallis & Futuna. Technip intends to do the same for the upcoming campaigns proposed in that project.

Name of partner:
Bundesanstalt für Geowissenschaften und Rohstoffe (BGR)
Country:
Germany
Entity profile:
Governmental/public body
Role within the
commitment:
BGR will develop concepts and general requirements for the seafloor CSEM sensing system, and guide the development of the new CSEM-ALBATROSS Profiler, including data modelling and simulations. BGR will also adapt its own marine CSEM systems for SMS exploration and organize and participate in field trials and data analysis.

Name of partner:
Geological Survey of Finland (GTK)
Country: Finland
Entity profile: Governmental/public body
Role within the commitment: GTK will carry out preliminary beneficiation studies and mineralogical characterization in cooperation with Eramet. GTK will be in charge to transfer the data acquired in this preliminary stage into the SEAFLORES project related to the extraction and beneficiation of SMS deposits.

Name of partner:
GA Drilling
Country: Slovakia
Entity profile: Private sector - SME
Role within the commitment: GA Drilling will be focused on R&D of innovative method for drilling and real-time geochemical analysis of target rocks. This approach introduces an innovative way of material analysis during a concurrent drilling operation enabling analysis of material using atomic and molecular spectrometry. The method of concurrent drilling and sensing would considerably enhance the entire exploration process efficiency and profitability.

Name of partner:
DCNS
Country: France
Entity profile: Private sector - large company
Role within the commitment: DCNS will design, qualify and operate a dedicated seafloor drilling and sampling system. This system will feature cutting edge innovations in terms of in-situ analysis of the samples and early recovery of all or part of them, easy integration on a support ship, safe and secure deployment from the deck, efficiency in operations, thus providing the project with a cost-effective tool and eventually enabling a better scheduling of the campaigns.

Name of partner:
HERIOT-WATT UNIVERSITY
Country:
United Kingdom

**Entity profile:**
Academia

**Role within the commitment:**
- Adapt, develop, provide and operate instrumental equipment for deep-sea mining environmental monitoring.
- Prepare monitoring and survey program in order to conduct baseline environmental studies.
- Prepare and operate environmental survey for drilling operation.
- Participate to campaign (3 to 4).
- Analyze data collected during a four years monitoring and survey.

**Name of partner:**
AURUBIS

**Country:**
Germany

**Entity profile:**
Private sector - large company

**Role within the commitment:**
AURUBIS is the leading integrated copper group and the world’s largest copper recycler. We produce some 1 million t of copper cathodes each year and from them a variety of copper products. Production expertise is our strength and the driving force of our success. AURUBIS will capitalize on its experience and know-how to contribute to the project.

**Name of partner:**
Louis Dreyfus Armateurs (LDA)

**Country:**
France

**Entity profile:**
Private sector - large company

**Role within the commitment:**
As an experienced shipowner, Louis Dreyfus Armateurs “LDA” will share its expertise in maritime operations, offshore operations and surface transportation. LDA Group will participate to specification phase, modeling of maritime operations to validate the industrial solution and business plan.

**Existing EU contribution:**
No

**Period to implement the commitment:**
Thursday, 1 January, 2015 to Thursday, 31 December, 2020