SEVENTH FRAMEWORK PROGRAMME
THE PEOPLE PROGRAMME

*Annex I - "Description of Work"**

PART A:

Grant agreement for: **Initial Training Networks**
Call identifier: **FP7-PEOPLE-2013-ITN**

Implementation mode: **Multi-ITN**

Project acronym: **ABYSS**
Grant agreement no.: **608001**

Project full title: **Training network on reactive geological systems from the mantle to the abyssal sub-seafloor**

Date of approval of Annex I by REA: **24/05/2013**
Project start date: **01/03/2014**

**** This Annex I refers to the 2013 PEOPLE Work Programme (European Commission C(2012)4561 of 9 July 2012)***

A.1 Project abstract

Keywords:

Laboratory experiment, field work, multi-scale modelling, heterogeneity, open system, physico-(bio)chemical coupling, geochemistry, hydrodynamics, thermodynamic/thermokinetic databases, PhD, postdoc.

Abstract:

ABYSS is a training and career development platform for young scientists in Geodynamics, Mineralogy, Hydrodynamics, Thermodynamics and (Bio-)Geochemistry focusing on mid-ocean ridge processes and their environmental and economic impacts. It brings together 10 European research groups internationally recognized for their excellence in complementary disciplines and 4 Associated Partners from the Private Sector. ABYSS will provide training for 12 Early Stage Researchers and 3 Experienced Researchers through a structured and extensive program of collaboration, training and student exchange. ABYSS aims at developing the scientific skills and multi-disciplinary approaches to make significant advances in the understanding of the coupled tectonic, magmatic, hydrothermal and (bio-)geochemical mechanisms that control the structure and composition of the oceanic lithosphere and the microbial habitats it provides. An improved understanding of these complex processes is critical to assess the resource potential of the deep-sea. ABYSS will specifically explore processes with implications for economy and policy-making such as carbonation (CO_2 storage), hydrogen production (energy generation) and the formation of ore-deposits. ABYSS will also emphasize the importance of interfacial processes between the deep Earth and its outer envelopes, including microbial ecosystems with relevance to deep carbon cycling and life growth on the Primitive Earth. The ABYSS training and outreach programme is set up to promote synergies between research and industry, general public and policy makers. The main outcome of ABYSS will be twofold (i) develop a perennial network of young scientists, sharing a common technical and scientific culture for bridging the gaps in process understanding and make possible the exploitation of far off-shore mining of marine resources; (ii) to address the need to develop pertinent policies at the European and international level for preserving these unique environments.

PART B:

B.1 List of participants

B.1.1. List of Participants (full beneficiaries)

N°	Beneficiary name	Beneficiary short name	Private Sector *(Y/N)*	SME *(Y/N)*	Country	Month enter project	Month exit project
1 (Coordi-nator)	Centre National de la Recherche Scientifique	CNRS	N	N	France	1	48
2	Agencia Estatal Consejo Superior de Investigaciones Cientificas	CSIC	N	N	Spain	1	48
3	University of Southampton	USOTON	N	N	United Kingdom	1	48
4	Universität Bremen	UBREM	N	N	Germany	1	48
5	Institut de Physique du Globe de Paris	IPGP	N	N	France	1	48
6	Universita Degli Studi di Milano	UNIMI	N	N	Italy	1	48
7	Universita Degli Studi di Genova	UNIGE	N	N	Italy	1	48
8	Gottfried Wilhelm Leibnitz Universität Hannover	LUH	N	N	Germany	1	48
9	Universitetet I Oslo	UIO	N	N	Norway	1	48
10	Norges Teknisk-Naturvitenkapelige Universitet	NTNU	N	N	Norway	1	48

B.1.2. List of Associated Partners (including role and status)

N°	Associated Partner name	Short name	Country	Organisation type	SME (Y/N)	Role in the project
1	Petroceramics SpA	PCERAM	Italy	Private	Y	TR, SEC
2	Statoil	STATOIL	Norway	Private	N	SEC
3	Nordic Mining ASA	NM	Norway	Private	Y	SEC
4	Merience Strategic Thinking	MERI	Spain	Private	Y	TR

B.2 S&T Quality

B.2.1. Objectives of the research programme

The ABYSS ITN coordinates 10 academic institutions and 4 private sector partners from across Europe to provide training for 12 Early Stage Researchers (ESRs) and 3 Experienced Researchers (ERs) in Geodynamics, Petrophysics, Mineralogy, Hydrodynamics, Thermodynamics and (Bio)Geochemistry. Through a structured, interdisciplinary and extensive programme of collaboration and student exchange, the project will combine the strength of leading European research groups to develop a training programme with **focus on the physical, hydrodynamic and geochemical processes controlling mass and energy transfers during the formation and cooling of the lithosphere at mid-oceanic spreading ridges**. The **linkages and feedbacks between these processes** and the **implications for life and marine resources in the deep-sea** will be a specific emphasis of the programme. The ABYSS research programme aims at developing the scientific tools and methodology to achieve the multi-scale integration of field, experimental, and analytical approaches, a first step to improve the theoretical and numerical modelling of highly reactive open systems such as deep marine (bio)geosystems, or any other dynamic Earth system with natural or anthropogenic environmental issues. It is organised into **Individual Research Project**s (**IRP**s) designed to address well-defined scientific problems, each project providing a training position for either an ESR or an ER. The ABYSS ITN will promote also a young scientist-driven outreach project to raise the profile of research in Geodynamics and Marine Geosciences and its role in understanding today's environmental challenges. This outreach project will give the ESRs/ERs the skills to communicate with the general public, media and policy makers. ABYSS will provide Europe with a network of young scientists, who will share a common culture and approach, able to address the scientific challenges rising from the ever-growing interest in deep sea resources and the need for developing pertinent policies at the European and international level for responsible use of deep-sea systems.

The **primary objectives of ABYSS** are:

1. **to train 12 ESRs and 3 ERs in state of-the-art concepts and leading-edge research techniques**, combining laboratory experiments, field measurements, analytical techniques, and modelling, with a strong focus on the acquisition of inter-disciplinary knowledge that are essential to study the behaviour of complex natural systems, while providing them strong career-management skills and solid professional connections;
2. **to advance knowledge on the processes that drive the formation of the oceanic lithosphere** at mid-ocean ridges and its early alteration, and the linkages between these magmatic and hydrothermal processes and their impact on deep sea natural resources and the development of life.
3. **to increase the impact and international visibility of European research in Geodynamics and Marine Geosciences**, in particular with regards to the general public, media and policy-makers, by structuring the research training, dissemination and outreach capacities via the establishment of a long-term collaboration and synergy between fundamental research institutions and private sector partners.

ABYSS is organised into **8 work packages** (*Table 1*) having common and individual milestones (*Table 4* - Section B.4.1). A well-defined set of deliverables will allow monitoring and assessing the success of the project in reaching its objectives of training, research, dissemination and outreach (*Table 6* - Section B.5). The first two WPs, coordinated by Marguerite GODARD (CNRS), are dedicated to the management of the project (WP1) and to the recruitment of ESRs and ERs (WP2) (see Section B.4.3). The next four WPs organize the training programme of each ESR and ER, by combining IRPs (WP3 & WP4; see Section B.2.2) and a common series of short-courses and seminars, practical projects and a personal training programme of

specialized scientific and technical knowledge and transferrable skills (WP5 & WP6; see Section B.3). The last two WPs focus on communication (WP7 & WP8; see Sections B.5.2 and B.5.3).

Table 1. List of Work Packages

Work package No	WP Type	Work package title *(Coordinators)*	Deliverables (D) / Milestones (M)	Lead beneficiary	Start month	End month
WP1	MGT	**Management** *(M.Godard – CNRS)*	D1.1, D1.2, D1.3, D1.4 / M1, M18	CNRS	1	48
WP2	MGT	**Recruitment** *(M.Godard – CNRS)*	D2.1, D2.2, D2.3 / M2, M3, M7	CNRS	1	24
WP3	RTD	**Dynamic melt-rock interactions: building the oceanic lithosphere** *(E.Rampone – UNIGE & J.Koepke – LUH)*	D3.1, D3.2 / M4, M8, M10, M12, M15, M16	UNIGE	8	48
WP4	RTD	**Cracks, fluxes & fluid-rock interactions: alteration of the oceanic lithosphere** *(W.Bach - UBREM & B.Jamtveit - UIO)*	D4.1, D4.2 / M12, M15, M16	UBREM	8	48
WP5	TR	**A state of the art on the oceanic lithosphere: Research and natural resources** *(P.Fumagalli – UNIMI & B.Ildefonse – CNRS)*	D5.1, D5.2, D5.3, D5.4, D5.5, D5.6, D5.7 /M11	UNIMI	8	30
WP6	TR	**Career development : research, industry and resource management** *(S.McEnroe – NTNU & D.Teagle – USOTON)*	D6.1, D6.2, D6.3, D6.4, D6.5 / M4, M5, M8, M9, M10, M12, M16	NTNU	8	48
WP7	DISS/ OUT	**Dissemination and exploitation** *(C.Garrido – CSIC & M.Scambelluri – UNIGE)*	D7.1, D7.2, D7.3, D7.4, D7.5, D7.6 / M12, M14, M16, M17	CSIC	2	48
WP8	DISS/ OUT	**Outreach** *(B.Menez – IPGP & M.Martell – MERI)*	D8.1, D8.2, D8.3 / M6, M13	IPGP	8	48

B.2.2. Research methodology and approach

The formation and alteration of the oceanic lithosphere represent one of the main processes for energy and chemical exchanges between the deep Earth and its outer envelopes. However, the **steep thermal gradients in these environments** mean that the physical and chemical **mechanisms controlling these exchanges remain poorly understood**, especially **at the main thermal and lithological boundaries**. Yet, these interfaces are the main transitions for the physical and rheological properties of rocks, such as deformation, permeability, and viscosity, that control melt focussing and transport from the partially molten mantle to the surface, and the influx of seawater into the cooling oceanic lithosphere. Understanding these processes is fundamental also because of their **socio-economic and environmental impacts**: they give rise to hydrothermal systems that produce economically valuable ore-deposits and play a major (although still poorly quantified) role for the global carbon budget. Some hydrothermal reactions produce hydrogen and abiotic hydrocarbons, and these extreme environments are implicated in the origin and development of life.

To understand these environments, it is necessary to comprehend and integrate the role of transport of magmatic melts and hydrothermal fluids through the oceanic lithosphere, and their feed-back on its physical and chemical properties that shape life habitats. Traditionally the formation of oceanic lithosphere has been envisioned as a suite of mantle and crustal magmatic processes, followed by

high- to low-temperature hydrothermal processes, which in turn support the development of rich and diverse ecosystems, each occurring in independent domains (magmatic vs. hydrous vs. biosphere) and the interactions and feedbacks controlling mass and energy transfers at their boundaries have been mostly overlooked. **Understanding such complex natural systems** will **require a shift of approach encompassing multi- and trans-disciplinary training and the development of new scientific tools**. ABYSS will provide comprehensive training programme for the next generation of European researchers on deep oceanic lithosphere-hydrosphere-biosphere systems; it will develop the scientific knowledge and develop methodologies to quantify these complex coupled processes and integrate observations into overarching theoretical and numerical models of the oceanic lithosphere. The ABYSS research and training programme focuses specifically on the development of new field, experimental and analytical approaches to:

• Measure the changes of the chemical and physical properties in the melt/fluid percolated lithosphere across the thermal and lithological boundaries, in particular at pressure and temperature conditions that are at the limits of the magmatic, hydrological and biotic domains and far from thermodynamic and chemical equilibrium;

• Parameterize the coupling between physical and (bio-)geochemical processes during magmatic and/or fluid transport, from the mineral surface scale (10^{-10} m) to that of the lithosphere (10^{4} m);

• Develop and refine methods to quantify the impact of melt and/or fluid-rock interactions at the crystal scale, and their effects on the overall geochemical and geophysical signature of the lithosphere;

• Integrate micro- to field observations and measurements over a large range of time scales from microbial life span (10^{6}-10^{7} s) to global Earth dynamics (>10^{13} s).

The ABYSS project brings together research groups and private sector partners with broad and complementary expertise and scientific interests, from mantle magmatism to microbial life. All recognize the need to develop inter-disciplinary and integrative approaches and to share methods and skills to address the scientific challenges rising in their specific research domains. The ABYSS research and training programme will specifically **promote collaborations and exchanges** between **research groups working on high-temperature magmatic and lower temperature hydrothermal systems,** and between **academia and private sector**. The **10 Full Participants** are **research institutions and universities** recognized for their excellence in complementary fields of Earth Sciences. Their expertise cover the entire range of methods and scales essential to investigate the open mid-ocean ridge system in a dynamic Earth context, and to master/develop relevant scientific tools such as (1) the characterization of deformation and melt-rock vs. fluid-rock chemical exchanges by direct analysis of geological materials and remote geophysical probing of the lithosphere composition, temperatures, and deformation, (2) experimental techniques to measure rheological, physical, petrological and chemical parameters in close and open multi-phase systems at pressures and temperatures analogue to deep Earth's environments; and (3) thermodynamic and reactive transport modelling to describe the thermo-mechanical and chemical evolution of the lithosphere from the scale of the pore/crystal to that of global chemical exchange fluxes. The **4 Associated Partners from the private sector** complete the network, by broadening the range of disciplines and skills proposed in the ABYSS research and training programme. They will participate via secondments and specialized courses and seminars/visits. ABYSS will also benefit from the collaboration with a high-technology start-up nurtured by CNRS, *VOXAYA*, to be launched in Fall 2013. The future co-founders, until recently post-docs in our institution, will participate in the ABYSS research and training programme (see Sections B.3 and B.4.2). Private sector involvement will illustrate entrepreneurship, the possibilities of transfer of knowledge between academia and industry and the organisation/management of SMEs and a large company, while providing access to the complementary technologies and skills required to reach the scientific, training and outreach objectives of the ABYSS project.

At the core of the ABYSS research programme are **cross-disciplinary research projects** to address specific scientific challenges by combining: case studies of well-chosen target areas; specifically designed

laboratory experiments and measurements; and numerical modelling, with a special focus on the multi-scalar integration of the results. Each project involves at least two different disciplinary approaches and will be co-supervised by senior scientists from different institutions via secondments. These research projects form **two research-based work packages,** which are centred on better understanding of the linkages between the magmatic, hydrothermal and biotic processes that control the formation and alteration of oceanic lithosphere. **Each WP is structured as a suite of IRPs** (see Section B.4.2); each project provides a training position for either an **ESR who will pursue a PhD**, or an **ER following a postdoctoral research programme** (*Table 3*, see Section B.4.1).

• WP3. Dynamic melt-rock interactions: building the oceanic lithosphere

The formation of the oceanic lithosphere is controlled by melt transport from the mantle to the surface, which in turn, controls the structure of the lithosphere by two competitive processes: the conduction and advection of heat from depth, and cooling by conduction and hydrothermal circulation.
Three research projects are dedicated to better constrain melt focussing toward the spreading ridges and melt accumulation processes at and across the mantle-crust boundary, and more particularly, to determine the role of fractional crystallization and reactive porous melt flow in the formation of lower oceanic crust, and the control such processes exert on melt evolution in the oceanic crust using laboratory experiments (ESR1) and field-based studies (ESR2 and ESR3). Two projects aim to develop new criteria to better constrain the cooling of the newly-formed lithosphere and hydrothermal – magmatic interactions, by combining geochemical tools and experimental and field approaches (ESR4 and ESR5). The extent and efficiency of heat transport by hydrothermal circulation during the cooling and crystallisation of magma within the lower oceanic crust remains one of the greatest unknowns in our understanding of mid-ocean ridge formation processes, and must control the size and distribution of magma chambers, as well as the magnitude of chemical exchange fluxes. ER1 builds on the expertise, methods and approaches developed in the ITN to improve exploration models and methods for future discovery of unexposed onshore and offshore ore-deposits.

• WP4. Cracks, fluxes & fluid-rock interactions: alteration of the oceanic lithosphere

Circulation of seawater within the cooling oceanic lithosphere is of critical importance in elemental and heat exchange budgets on Earth. A large set of complex and interrelated physical and chemical processes govern how much and where in the system reaction between fluid and rock takes place. The types of reaction include carbonation (CO_2 sequestration), hydrogen production (energy generation), and various reactions in the source-to-trap processes that lead to the formation of ore-deposits. Understanding the fluid-rock interactions more comprehensively is crucial in assessing the potential use of the ocean floor as a resource and in appreciating the role life sustained by these interactions in Earth's geochemical cycles. ESR6, ESR7 and ESR8 explore the couplings between chemical, mechanical and hydrodynamic processes as well as the effect of transport, and fluid and rock compositions on rates and products of reactions in hydrothermal open systems. Using experimental and observational approaches, ESR8, ESR9 and ESR10 examine carbonation processes, and ESR10 and ESR11 investigate abiotic and biotic forms of carbon and carbon mineralization in hydrothermally altered mantle rocks. Mapping serpentinization reactions and developing geophysical tools needed in prospecting deposits tied to ultramafic rocks is the goal of ESR12. The last two projects require synthesis skills and numerical modelling, and these are consequently best carried out by Experienced Researchers with advanced specialist knowledge. ER2 will combine 3D microanalyses of reacted samples (in collaboration with WP4 participants) and numerical approaches to develop pore-scale models allowing to predict the linkages between chemical and transport processes during open system reactions. ER3 will combine reactive flow experiment and advanced isotope geochemistry to test and calibrate the isotopic tools commonly used today to determine the extent of fluid flow during the hydration of the oceanic lithosphere.

B.3 Training

B.3.1. Quality of the training programme

The ABYSS project is designed as a coherent platform for training and career development of young researchers (ESRs/ERs), around the broad theme of the formation and alteration of the oceanic lithosphere. At the core of the network are **10 European leading research institutions and universities**. The network will train multidisciplinary scientists with unrestricted ambitions for their future career plans: the network will enable young researchers to gain knowledge, not only in their own prime area of study, but across a broad range of disciplines and expertise that will be provided, in particular, by the **Associated Partners**, all from the private sector.

The **private sector involvement** in ABYSS **aims at illustrating entrepreneurship, the possibilities of transfer of knowledge between academia and industry** and the organisation/management of SMEs and a large company, while providing **access to the complementary technologies and skills** required to reach the scientific, training and outreach objectives of the ABYSS project. The 4 Associated Partners will participate to the ITN mainly via secondments, specialized courses and seminars/visits. Visits and seminars will be organized in coordination with the ABYSS meetings and workshops (*Table 2*). Overall, 6 ESRs/ERs will benefit from strong collaborations with private sector during their IRPs (see Section B4.3), via secondments (ESR1 at PCERAM; ESR6 and ER1 at NM; ESR8 and ESR12 at STATOIL) and, for the last one (ER2), via close supervision of the IRP by the co-founders of the incubated start-up VOXAYA (to be created at Fall 2013). Three of these IRPs address gaps in knowledge brought up by the private sector (ESR12, ER1 and ER2). Finally, MERI is strongly involved in the coordination of WP8 and, more particularly, it is central to the development of the SeaRock Blog project (see Section B.5.3), to which all ERs/ESRs will participate. This incorporation of skills offered by the private sector companies associated with this project recognizes the likelihood that all the graduates with advanced scientific degrees will not go into academia. They may pursue scientific careers in industry, or apply their scientific expertise in other areas in the commercial sectors, and thus, it is essential to instil "commercial awareness" into the ESRs and ERs.

The ABYSS Training Programme is organized around **IRPs** (**WP3** and **WP4**; see Sections B.2.2 and B.4.2) and two training-based work packages; the first focusses on scientific training (**WP5**) and the second organizes personal and career development, synergistic activities and the acquisition of transferrable skills (**WP6**). Each ESR and ER will have a personalised training program mutually agreed upon recruitment. This **Personal Career Development Plan** (**PCDP**) will directly reflect his/her personal training needs (including skills requirements) and career objectives. **WP6** is central to the realization of the PCDP of each ESRs/ERs: (i) it coordinates their personal research and training programme as well as the ABYSS meetings and workshops, which provide fellows with opportunities to regularly present and discuss their results (jointly with WP3/WP4, WP5), and (ii) it organizes the acquisition of transferable skills through personal and synergistic activities, to broaden and improve their employability. Finally, for the duration of their fellowships, all ESRs/ERs are expected to attend and participate to the network workshops, meetings and short-courses, and joint dissemination projects.

Secondments and **short visits** to other partner institutions are an essential aspect of the training programme (**WP5**): they will promote instrumental/techniques versatility and cross-interaction among disciplines and institutions. They are necessary also for passing on specific knowledge on methods or instrument-related training, for building up the cohesion of the network, and for the effective participation of all senior and junior researchers in the network scientific programme. Each ESR/ER project involves at least 2 participants/associated partners in addition to the Host Institution. ESRs/ERs will visit collaborators

regularly for periods ranging from one week (for discussions and participating in training sessions) to a few months (to acquire specific training and performing experiments).

Each ESR/ER will be monitored by a **Young Scientist Advisory Board** (**YSAB**) (see Section B.4.3). The YSAB will assist the fellow in designing his/her PCDP, in evaluating the work progress and the fulfilment of the PCDP, and, if necessary, advise alternative approaches. **Progress reports and updated personal training plans will be submitted to the ABYSS Supervisory Board each year**. The general timelines for recruitment and training for the ERs will be more flexible, as the duration and objectives of the ER projects are extremely variable (Section B.4.3.3).

B.3.2. Network-wide training events, schools, conferences, workshops

• **Five thematic short-courses will be organised** by the ABYSS ITN **to provide a common basis of knowledge on the formation and alteration of the oceanic lithosphere to the ITN participants**, who will have broad scientific backgrounds **(WP5)**. They will combine lectures given by international authorities with practical training modules, discussions and student talks; when logistics permit, they will be open to other young scientists (~10-12) either from the institutions participating to the ITN or from ERA countries.

⇨ **Short-Course 1 (SC1) - Formation and evolution of the Ocean Crust: Field trip to the Troodos ophiolite, Cyprus** *Supervisors: D. Teagle (USOTON), B. Ildefonse (CNRS), M. Godard (CNRS) & T. Henstock (USOTON)*

The Troodos ophiolite, Cyprus, is an ancient slice of ocean crust formed ~90 million years ago. Recent uplift and erosion have exposed a world-class section through the ocean crust and uppermost mantle. These outcrops provided many of the observations that led to early models of the ocean crust, a key ingredient for the development of plate tectonic theory. The compact size and easy access to outcrops from the mantle to metalliferous deposits, make Troodos unrivalled for field based learning, and the visualization of the interplay between geological, hydrothermal, structural, and mineralization processes. Structured field exercises will be interspersed with "back of the envelope" thermal, fluid-flow, and geochemical calculations to enable researchers to develop an intuitive understanding of the mid-ocean ridge environment. This **6-day field course**, early in the ITN will be instrumental in building the "ABYSS Team" and facilitate on-going research collaborations.

⇨ **Short-Course 2 (SC2) - The oceanic lithosphere: State of the art of research and marine exploration techniques** *Supervisor: W. Bach (UBREM)*

This **5-day short course** will focus on exploring and sampling the seafloor. State-of-the-art ship-based and deep-towed geophysical and geochemical techniques used in modern deep-sea research will be introduced in lectures and practicals, including training in a simulator van for work with remotely-operated vehicles harboured at MARUM. The Bremen Core Repository of the Integrated Ocean Drilling Program and its laboratory will also be used heavily in the training course. A "Virtual Ship" program will simulate all the working steps on-board a drilling vessel, including core logging, physical property measurements, X-ray and magnetic core scanning techniques, as well as macroscopic and microscopic petrological and structural studies on selected cores, which represent a range of different geotectonic settings (mid-ocean ridges, rifted continental margins, detachment faults). The short-course will provide comprehensive training in planning, preparing, and conducting seagoing research.

⇨ **Short-Course 3 (SC3) - Advances in imaging and analytical techniques for (bio)petrology** *Supervisors: B. Menez (IPGP), M. van Zuilen (IPGP), D. Brunelli (UNIGE)*

This **7-day short course** focuses on the cutting-edge techniques used in petrology and geobiology, two disciplines fundamental for the integrated study of the processes associated with the dynamics of the oceanic lithosphere. It will benefit from the IPGP analytical infrastructure for the practical sessions along with the

support and access to the French national Synchrotron facility SOLEIL. Students will receive interdisciplinary and practical training at the interface between those disciplines along with the associated concepts of (bio)geochemistry, petrology and mineralogy. Techniques taught include: 2D-3D image analyses, electron microscopy (SEM, TEM, STEM, EELS) and micro-analysis, vibrational spectroscopies (Raman, FTIR, CLSM), synchrotron-based techniques (µXRF, µXAS, µXRD, µtomography), in situ stable isotopes analyses (SIMS, nano-SIMS), all adapted to the characterization of mineral and organic phases. Recent scientific breakthroughs utilizing these techniques will be reviewed and discussed.

⇨ **Short-Course 4 (SC4) - Experimentation in geology** *Supervisors: P. Fumagalli (UNIMI) & J. Koepke (LUH)*

This **6-day short course held in Hannover (LUH) and in Milan (UNIMI)** with contributions of PCERAM will focus on the experimental strategies used to simulate deep geological processes at oceanic spreading ridges and on the transfer of experimental and analytical knowledge to industrial processes. It builds on the complementary skills and facilities of LUH and UNIMI, and provides insight on transfer of expertise from fundamental research to industrial processes (PCERAM). It will start in Milan, with a presentation of the methods and strategies used in experimental petrology and constraints on oxygen fugacity during HT-HP experiments, followed by a day of practical training at UNIMI using both static and "rocking" devices, with analysis of experimental products and data evaluation, and a day visit at PCERAM. After transfer to Hannover, the short course will continue with a one-day presentation of the principles of magmatic modelling followed by 2 days of practical training, first by performing a HT-HP experiment using internally heated pressure vessels (IHPV) (from capsule preparation to data evaluation) then practical work on fractional crystallization using COMAGMAT.

⇨ **Short-Course 5 (SC5) - The coupling between chemical reactions and mechanical processes** *Supervisors: B. Jamtveit (UIO) & S. McEnroe (NTNU)*

The **6-day course** will focus on mechanical processes coupled to reactive transport in porous rocks. The course will start with a 2-day field trip to localities of serpentinised ultramafic rocks where examples of reaction driven fracturing during serpentinization will be studied. During the following 4-day workshop, the basics of reaction-path modelling will be introduced (2 days) with practicals using the most commonly used codes (e.g. Phreeqc). Then the thermodynamic basis for mechanical-chemical coupling will be reviewed, and simple discrete-element models (DEM) will be constructed to study the effects of volume changing reactions in elastic media. We will also study how the fracture patterns emerging during reactive transport may depend on far-field stresses as well as on time-dependent processes, such as diffusion rates, the kinetics of chemical reactions and fluid flow rates.

• **Postgraduate-level specialized courses** provided by the 10 partner institutions as part of their educational programmes will grant the fellows the complementary skills needed to complete their personal research project. These courses will be available to all fellows of the network. Each fellow will define in coordination with the YSAB, the courses relevant to their PCDP. ERs and ESRs will also be supported in attending specialized short-courses provided by other Institutes, Research Councils and other national agencies.

• ***Activities shared by the research and training work packages:***

⇨ The **ABYSS meetings** and **workshops** will alternate (*Table 2*): the 2 day meetings will allow the fellows and supervisors to discuss informally the progress of the science and training programme, present new results to the members of the network and, eventually discuss problems and conflicts; the **annual workshops** (3-5 days) have broader purposes, in particular **dissemination of the results of ABYSS project and networking**. Leading specialists will be invited to deliver high-level scientific talks/lectures and exchanges and break-out sessions will be organized to enable discussion between ESRs, ERs and senior researchers within and from outside the network. These workshops will also give the ERs and ESRs the opportunity to develop their presentational skills, since each fellow will be expected to give an oral presentation of her/his

work. ERs and ESRs will be encouraged to participate actively in the organization of the workshops in order to develop their management skills. The ESRs/ERs will also fully manage a special parallel session, which will allow a free exchange of views on the network functioning. The 2nd and 3rd workshops will be open, on invitation, to participants of the host institutions, invited scientists, and members of other ITNs to promote co-operation amongst research institutes in Europe. **The 4th workshop will be a high profile international event**, open to a larger number of external participants (~20-25), **to ensure the widest dissemination of the results of ABYSS research and training programme in the international community.**

Table 2. Training activities

	Training events, workshops & conferences	Lead Organising Institution	Planned date	Planned location	Planned duration	Participants[1]
1	1st workshop "Reactive geological systems from the mantle to the abyssal sub-seafloor"	CNRS	Month 8	Montpellier (France)	2-3 days	GA
2	SeaRock Blog – A student led outreach project : 1st training meeting	CNRS	Month 8	Montpellier (France)	1 day	ESR/ER, MERI
3	Short-Course 1 "Structure and processes building the Ocean Crust : Field trip to Cyprus"	USOTON	Month 15	Cyprus	6 days	ESR/ER, S,
4	Short-Course 2 "The oceanic lithosphere : A state of the art of research and marine exploration techniques"	UBREM	Month 17	Bremen (Germany)	5 days	ESR/ER, S
5	Project Mid-term Meeting 1	UBREM	Month 17	Bremen (Germany)	2 days	GA
6	SeaRock Blog - A student led outreach project: 2nd training meeting	MERI	Month 17	Bremen (Germany)	1 day	ESR/ER, MERI
7	2nd workshop "Reactive geological systems from the mantle to the abyssal sub-seafloor"	IPGP	Month 20	Paris (France)	3-4 days	GA
8	SeaRock Blog - A student led outreach project: 3rd training meeting	MERI	Month 20	Paris (France)	1 day	ESR/ER, MERI
9	Short-Course 3 "Advances in imaging and analytical techniques for (bio)petrology"	IPGP	Month 20	Paris (France)	7 days	ESR/ER, S
10	Project Mid-term Meeting 2 (including Field Trip to Ligurian ophiolites) (Genova, Italy)	UNIGE	Month 26	Genova (Italy)	2 (+2) days	GA
11	SeaRock Blog - A student led outreach project : Final training meeting	IPGP	Month 26	Milano (Italy)	1 day	ESR/ER, MERI
12	Short-Course 4 "Experimentation in geology" (UNIMI/LUH)	UNIMI, LUH	Month 26	Milano (Italy), Hannover (Germany)	6 days	ESR/ER, S
13	Short-Course 5 "The coupling between chemical reactions and mechanical processes" (UIO / NTNU)	UIO, NTNU	Month 29	Oslo & Trondheim (Norway)	6 days	ESR/ER, S
14	3nd workshop "Reactive geological systems from the mantle to the abyssal sub-seafloor"	UIO	Month 32	Oslo (Norway)	3-5 days	GA, Open
15	Project Mid-term Meeting 3 (including Field Trip to Ronda)	CSIC	Month 38	Granada (Spain)	2 (+2) days	GA
16	Special Session at European Geosciences Union Annual Meeting	CSIC	Month 38	Vienna (Austria)	5 days	Open
17	4th workshop "Reactive geological systems from the mantle to the abyssal sub-seafloor"	USOTON	Month 44	Southampton (UK)	3-5 days	GA, Open
18	Special Session at American Geophysical Union Fall Meeting	CNRS	Month 46	San Francisco (USA)	5 days	Open

[1] GA = General Assembly (i.e ESR/ER, Full and Associated Partners); S = Supervisors of the Short Courses; Open = All participants in the project and beyond (open to a broader public).

⇨ Two sessions on the network research themes will be organized in international conferences (*Table 2*) as part of the ABYSS dissemination programme (**WP7**; see Section B5.2). All ESRs/ERs will be required to participate to these events that will be planned during the last year of the project to provide the opportunity for each fellow to **present formally his/her research project in front of a very large scientific audience**.

⇨ **Field excursions to major mantle and crustal exposures** will be organized. They have a double objective: (i) team-building, to strongly enhance the cohesion and exchanges within young and senior researchers in the network and (ii) providing the fundamental opportunity for experimentalists and modellers to work on the field. The field trips to Cyprus and the Norway ophiolites are integrated in Short-Courses 1 and 5 respectively. The field trips to the Ronda massif (Spain) and the Ligurian ophiolites (Northern Apennines, Italy) will provide the unique opportunity to observe in exposed mantle and crustal sections, the magmatic and, locally, hydrothermal processes acting in the thinning of subcontinental mantle to oceanic transition lithosphere and the formation of very slow spreading oceanic lithosphere, respectively. ESRs and ERs, whose projects involve field work, will participate in the organization of the field trips. This exercise will significantly strengthen their organizational skills. It will also provide practical training on safety issues during fieldwork.

- ***Career development and synergistic activities:***

⇨ Fellows will be encouraged to attend the **personal and career-development oriented courses** offered by their host academic institutions. Of highest priority will be to attend courses on the national languages for foreigners and on communication skills (communicating research to non-experts and the media, writing and presentation skills, body language and rhetoric). Other desirable transferable skills include collaboration, knowledge transfer and entrepreneurship skills (project management, fund-raising, creativity and generation of ideas), intra-personal skills (self-awareness, time-management, stress-management, work/life balance), networking and ethics and social responsibility. Modules on safety issues during laboratory and field work will also be provided. This part of the training programme will be **defined on a yearly basis in coordination with the YSAB according to their PCDP;** it will account for **10-15 days per year**. Although these courses and training sessions will be mainly held at institutional level, fellows will also have access to courses at other partner institutions.

⇨ **Seminars on transfer of technology from academia to industry, IPR, entrepreneurship and on employment opportunities in their activity area will be offered by the 4 Associated Partners**. Seminars will take place during the network mid-term meetings and workshops to ensure that all fellows can attend. They will allow all ESRs and ERs to get to know the functioning of a large multinational company (STATOIL) and of SMEs in different fields of professional activity. Emphasis will be put on communication in the field of risk, a major issue for geoscientists as shown by the recent trial of Italian geoscientists, convicted over L'Aquila earthquake. Training will be completed by seminars on business creation, through the example of VOXAYA. These seminars by the two (future) co-founders, two young researchers presently post-doctoral researchers at CNRS, will provide the ESRs and ERs the unique opportunity to follow the development of a start-up during the early days and years of its activity, and therefore better assess their PCDP, should they wish to create a company.

⇨ **External networking** will be encouraged to discuss with the wider scientific community, and to make contacts for future work opportunities. The ABYSS trainees are expected to attend at least two international conferences to present their scientific results, in addition to the two special sessions organized by ABYSS as part of its dissemination programme (**WP7**; see Section B5.2). ERs will also be encouraged to convene sessions in international conferences on the network research themes in collaboration with one of the senior researchers. This will allow them to develop their organizational skills and help them to get known in the Earth Sciences community. Young scientists will be also encouraged to interact with the European networks, such as mineralogical (or professional) societies, or ITN projects (e.g., MINSC, FLOWTRANS). Finally, the ABYSS trainees will be asked to organize the ABYSS 4th workshop (logistics, programme, animation),

which will be opened up beyond the network members. This will provide the ESRs/ERs the opportunity to interact informally and scientifically with a wider public audience.

⇨ Practical **outreach activities** (**WP8**; see Section B5.3) will be organized to help the ESRs/ERs **to develop their communication, management and networking skills.** These activities will include: participation of the ERs in the supervision of the ESRs research projects, shared responsibility by the maintenance of the ABYSS webpage, participation to the communication activities of the Host Institutions (open days, Fête de la Science, seminars in schools) and to the organization of the network field trips, workshops and short courses. The **SeaRock Blog Project,** a student driven project, will be at the centre of these activities: it will provide a framework in which the ESRs/ERs will communicate on their project, ABYSS and more generally on deep sea research. The ESRs/ERs will participate in the creation of the blog then they will be in charge of its management, under the supervision of moderators. **The early stages of the project will be accompanied by a series of one-day practical training meetings supervised by MERI**, a strategic consulting company specialized in the communication with the general public and policy makers in the field of risk and for environmental governance, that is associated to the project (*Table 2*). This project will provide to the ESRs/ERs an invaluable practical training and expertise on research and scientific communication toward the general public, media and policy makers and on the management of communication projects.

Whenever possible, the ABYSS workshops and project meetings will be organized close (in time and space) to short-courses and field-trips to reduce costs.

B.4 Implementation

B.4.1. Workplan

ABYSS aims at the comprehensive training of 15 young researchers (*Table 3*) through a large and innovative training network grouping 14 academic and private sector partners. To address the objectives defined for its 8 work-packages *(Table 1*), the work plan is organized as a suite of milestones (*Table 4*) and well-defined deliverables (*Table 6*, see Section B5.1).

Table 3. List of Fellows' individual projects

Fellow number	Project title	Host institution	Relevant Work Package(s)	Duration (months)	Indicative start date
ESR1	Melt-rock interactions at the mantle-crust interface in oceanic spreading environments: An experimental investigation	UNIMI	WP3	36	Month 8
ESR2	Melt-rock interactions in the oceanic lithosphere: microstructural and petro-geochemical constraints from ophiolites	UNIGE	WP3	36	Month 8
ESR3	Melt-rock interactions in the oceanic lithosphere: microstructural and petro-geochemical constraints from drill-cores	CNRS	WP3	36	Month 8
ESR4	Experimental rock/brine interaction at high and very high temperatures in magmatic systems	LUH	WP3	36	Month 8
ESR5	Hydrothermal cooling of the lower oceanic crust	USOTON	WP3	36	Month 8
ESR6	Replacive formation of massive sulphide deposits: An experimental approach	UBREM	WP4	36	Month 8
ESR7	Coupling between mechanical processes and reactions during serpentinization	UIO	WP4	36	Month 8
ESR8	Coupling between hydrodynamic properties and reactions during serpentinization : Impact on H_2 / CO_2 budgets	CNRS	WP4	36	Month 8
ESR9	CO_2 sinks in the oceanic lithosphere: natural constraints on carbonation of ultramafic rocks	CSIC	WP4	36	Month 8
ESR10	Carbonate precipitation in alkaline serpentine-hosted hydrothermal vents	CSIC	WP4	36	Month 8
ESR11	The ocean crust as microbial incubator	IPGP	WP4	36	Month 8
ESR12	Geophysical expression of serpentinites: Mapping the reactions that produce magnetic minerals and developing exploration tools for potential economic deposits.	NTNU	WP4	36	Month 8
ER1	Importance of pre-emplacement processes upon economically fertile mafic melts	NTNU	WP3	20	Month 15
ER2	Multi-scalar modelling of hydrothermal fluxes in the mantle lithosphere	CNRS	WP4	24	Month 20
ER3	Calibration of isotopic tracers to determine water-rock interactions: an experimental approach	USOTON	WP4	24	Month 20

The network as a whole undertakes to provide a minimum of 500 person-months of Early Stage and Experienced Researchers whose appointment will be financed by the contract. Quantitative progress on this, with reference to the table contained in Part C and in conformance with relevant contractual provisions, will be regularly monitored at the consortium level.

Table 4. List of Milestones (including associated Work Packages (WP)

Milestone (WP)	**Milestone description (Lead Beneficiary)**	**Month**
M1 (WP1)	Kick-off meeting: establishment of Steering Committee & Supervisory Board; discussion of financial procedures (**CNRS**)	1
M2 (WP2)	Establishment of ESRs/ERs Recruitment Committees (**CNRS**)	1
M3 (WP2)	Recruitment of ESRs (**ALL**)	8
M4 (WP3-6)	1st workshop *Reactive geological systems from the mantle to the abyssal sub-seafloor* (**ALL**)	8
M5 (WP6)	Establishment of YSAB & PCDP for each ESR (**ALL**)	8
M6 (WP8)	SeaRock Blog Project on the web (**ALL**)	17
M7 (WP2)	Recruitment of ERs (**CNRS, NTNU, NM, USOTON**)	20
M8 (WP3-6)	2nd workshop *Reactive geological systems from the mantle to the abyssal sub-seafloor: ESRs first formal scientific presentations* (**ALL**)	20
M9 (WP6)	Establishment of YSAB & PCDP for each ER (**ALL**)	20
M10 (WP3-6)	Analysis of each ESR project: discussion of scientific progress and PCDP, decisions and recommendations for the continuation of training & research programme *(D3.1; 4.1; 6.3)* (**ALL**)	20
M11 (WP5)	Analysis of impact of Programme of Short-Courses *(D5.7)* (**ALL**)	30
M12 (WP3-4, 6-7)	3rd workshop *Reactive geological systems from the mantle to the abyssal sub-seafloor: ESRs/ERs formal scientific presentations* (**ALL**)	32
M13 (WP8)	Mid-project analysis of ESR/ER participation to and impact of SeaRock Blog Project *(D8.2)* (**IPGP, MERI**)	32
M14 (WP7)	Special Session at European Geosciences Union Annual Meeting *(D7.3)* (**ALL**)	38
M15 (WP3, 4)	Individual scientific reports for each ESRs and ERs *including* ***at least one publication submitted at the date of the report*** *(D3.2 & 4.2)* (**ALL**)	40
M16 (WP3-4, 6-7)	4th workshop *Reactive geological systems from the mantle to the abyssal sub-seafloor* (**ALL**)	44
M17 (WP7)	Special Session at American Geophysical Union Fall Meeting *(D7.4)* (**ALL**)	46
M18 (WP1)	Final Meeting: Evaluation of the Project *(D1.5)* (**ALL**)	48

B.4.2. Fellows individual research projects

ESR1	**UNIMI**	**36 months**	**Month 8**
Project title: Melt-rock interactions at the mantle-crust interface in oceanic spreading environments: An experimental investigation (WP3) Supervisor: ***P. Fumagalli*** – Co-supervisors: M. Valle (PCERAM) & J. Koepke (LUH) PhD enrolment: Y			
Objectives: Acquisition of experimental expertise, development of strategies to simulate geological processes at high pressure and temperature in multi-component systems; Experimentally-based modelling of reaction mechanisms, kinetics, and effect of crystallization and reactive porous melt flow on the chemistry and physics of oceanic lithosphere			
Tasks and methodology: Choice of the starting bulk compositions (melts, ultramafic matrix); High pressure experiments in static and rocking end-loaded piston cylinders (P=0.5-1.0 GPa, T ≤ 1350°C), and in internally heated pressure vessels (IHPV) for crustal conditions (P<0.5 GPa) at variable PTX and time conditions; Microanalysis at electron microprobe, acquisition of BSE images of the melt-matrix interfaces; Texture analysis, comparison with natural rocks and modelling			
Results: Experimental database (mineral chemistry, melt compositions, textural features) on melt-peridotite interaction products; Comparison to natural observations of olivine-rich troctolites; *M3, 5, 10, 15 & D3.1, 3.2*.			
Dissemination: At least one publication in a peer-review journal must be submitted at the time of the individual scientific report (*M15*); Participation to ABYSS workshops & international conferences, in particular the planned ABYSS EGU & AGU sessions (*M14,17*); Participation to outreach activities organized at UNIMI and by ABYSS; SeaRock Blog project.			
Planned secondments: PCERAM, 1st year/1 month, Introduction to industrial research and processes / Use of high temperature furnaces; LUH, 2nd year/3 months, IHPV – low pressure experiments			

Risk assessment: The experimental techniques used in this project are robust and have already been successfully used in past projects, and needed analytical facilities are available in the host and secondments laboratories. The experimental strategies for reproducing melt-rock interactions require however careful set-up as it is not routinely adopted: the expertise and collaborative research among laboratories will help in experimental problem solving.

ESR2	UNIGE	36 months	Month 8
Project title: Melt - rock interactions in the oceanic lithosphere: microstructural and petro-geochemical constraints from ophiolites (WP3) Supervisor: ***E. Rampone*** – Co-supervisors: L. Crispini, D. Brunelli; M.Godard, B.Ildefonse (CNRS); D. Teagle (USOTON) PhD enrolment: Y			
Objectives: Define field relations of crustal rocks and host mantle peridotites in selected ophiolites, to constrain styles and mechanisms of magma intrusion; Provide geochemical and microstructural tools to constrain the origin (mantle vs. magmatic) of olivine in the lower oceanic crust, and determine the role of fractional crystallization and reactive porous melt flow. Model the effect of melt-rock reaction acting in the lower oceanic crust on the evolution of MORBs.			
Tasks and methodology: Field mapping and sampling of gabbroic rocks and host mantle peridotites in selected ophiolites (e.g. Erro-Tobbio, Ligurian Alps, Mt.Maggiore, Alpine Corsica); Microstructural analysis and imaging (SEM); Mineral major and trace element chemistry, by EMPA and Laser-ICP-MS; EBSD measurements of crystallographic preferred orientations (CPO); Sr-isotopic composition in plagioclase by (LA-)MC-ICP-MS			
Results: CPO and petro-geochemical database on gabbroic and mantle rocks in selected ophiolite sequences; Characterization of melt-rock interaction signatures in ophiolitic lower crust; *M3, 5, 10, 15 & D3.1, 3.2*.			
Dissemination: Participation to ABYSS workshops & international conferences, in particular the planned ABYSS EGU & AGU sessions (*M14,17*); Organization of field trip to the Ligurian Ophiolites; Participation to outreach activities organized at UNIGE and by ABYSS; SeaRock Blog project; At least one publication in peer-review journal (*M15*).			
Planned secondments: CNRS: 1st year, 2x1month; 2nd year, 1 month; EBSD, LA-ICPMS; USOTON: 2nd year/2 months; 3rd year: 1 month; Sr isotopic analyses in plagioclase			
Risk assessment: Samples are partly available and will be implemented with new field work and sampling. All necessary analytical facilities are available in the host and secondments laboratories, and the techniques well known. The potential risk of instrument breakdown will be overcome by using similar analytical facilities in Europe.			

ESR3	CNRS	36 months	Month 8
Project title: Melt-rock interactions in the oceanic lithosphere: microstructural and petro-geochemical constraints from drill-cores (WP3) Supervisors: ***B. Ildefonse & M. Godard*** – Co-supervisors: B. Rampone (UNIGE), D. Teagle (USOTON) PhD enrolment: Y			
Objectives: Acquire detailed information on microstructural and petro-geochemical signatures of gabbroic rock samples from ocean crust drill cores (ODP and IODP Expeditions; Mid-Atlantic Ridge and Southwest Indian Ridge); Understand and quantify to what extent crystallization and reactive porous melt flow in the lower oceanic crust may modify the chemistry of melts and the physico-chemical properties of the oceanic lithosphere			
Tasks and methodology: Selection of samples from ODP and IODP drill cores (e.g., ODP/IODP Holes 735B, 1275D, & U1309D; imaging and detailed petrographic & textural analyses; EBSD measurements of crystallographic preferred orientations (CPO); In-situ petro-geochemical analysis of constituent minerals (EPMA, LA-ICP-MS), Sr isotopes			
Results: CPO and petro-geochemical databases for ODP/IODP drill core samples; *M3, 5, 10, 15 & D3.1, 3.2*.			
Dissemination: Participation to ABYSS workshops & international conferences, in particular the planned ABYSS EGU & AGU sessions (*M14,17*); Participation to outreach activities organized at CNRS and Montpellier University and by ABYSS; SeaRock Blog project; At least one publication in a peer-review journal (*M15*).			
Planned secondments: UNIGE, 1st year/2x1 month, 2nd year 1 month; Petrographic imaging/analyses; USOTON, 2nd year/2 months, Sr isotopic analyses (plag.)			
Risk assessment: Risk of failure is limited: methodology has already been used successfully; all analytical facilities are available in the host and secondments laboratories. The samples are either available in the host lab, or can be easily completed by additional sampling at the IODP core repository in Bremen. A potential risk is unexpected instrument breakdown; it can be circumvented by doing the analytical work using similar facilities in other laboratories.			

ESR4	LUH	36 months	Month 8
Project title: Experimental rock/brine interaction at high and very high temperatures in magmatic systems (WP3) Supervisor: ***J. Koepke*** – Co-supervisors: R. Almmev (LUH), P. Fumagalli (UNIMI) & D. Teagle (USOTON) PhD enrolment: Y			

Objectives: Investigate experimentally rock/brine interactions at very high temperature to evaluate the mechanisms of the ongoing magmatic reactions in the deep crust and shallow mantle beneath mid-ocean ridges; Apply experimental results to nature by comparing experimental results with hydro-magmatic amphiboles from the oceanic crust by measuring bulk & mineral elemental and isotopic compositions to evaluate the extent of rock/water/brines exchanges at ridges.
Tasks and methodology: Experiments in Internally Heated Pressure Vessels (IHPV) at LUH (P≤ 200 MPa); Experiments with piston cylinder techniques at UNIMI (P≤ 1 GPa); Analysis of the experimental results with in-situ geochemical methods (EPMA; LA-ICP-MS); Bulk and in situ geochemical analysis of natural hydro-magmatic amphiboles from deep oceanic crust and shallow mantle with special focus on fluid-mobile trace elements and isotopic compositions (e.g., ^{87}Sr).
Results: Experimental data on rock/brine interactions for different P; partioning coefficients between silicate melt and minerals in presence of a high saline fluid/brine; Cl-rich amphibole geochemistry (oceanic crust and shallow mantle); Quantitative evaluation of rock/brine interactions within the deep crust/shallow mantle; *M3, 5, 10, 15 & D3.1, 3.2*.
Dissemination: One or two publications in a peer-review journal (*M15*); Participation to ABYSS workshops & international conferences, in particular the planned ABYSS EGU & AGU sessions (*M14,17*); Participation to outreach activities organized at LUH and by ABYSS and to SeaRock Blog project.
Planned secondments: UNIMI, second year, 2 months, high pressure Piston Cylinder experiments; USOTON, second year, 3 months , amphibole isotopic analyses
Risk assessment: All experimental and analytical techniques to be used in this project have been used successfully in many projects of the LUH and UNIMI labs. The experimental design on rock/brine interaction was tested in previous experimental series at LUH. Natural starting material and natural samples with amphiboles rich in chlorine are available. Hence, any risk related to this project is negligible.

ESR5	**USOTON**	**36 months**	**Month 8**
Project title: Hydrothermal cooling of the lower oceanic crust (WP3) Supervisors: ***D.A.H. Teagle*** & ***T. Henstock*** – Co-supervisors: J. Koepke (LUH), B. Ildefonse (CNRS). B. Jamtveit (UIO) PhD enrolment: Y			
Objectives: To test end member models of the magmatic accretion of the lower oceanic crust as exposed in the Samail ophiolite, Oman; To establish the geometry and distribution of magma chambers; To establish hydrothermal fluid flow pathways; To quantify the time integrated hydrothermal fluid fluxes; To establish the role of deep faults in channelling seawater-derived hydrothermal fluids; To improve our knowledge of trace element diffusion in olivine.			
Tasks and methodology: Mapping hydrothermal alteration of the lower oceanic crust in the Samail ophiolite; Petrography to identify the sequence of fluid-rock interactions; Micro-sampling of II^{ary} minerals for composition, stable and Sr isotope analyses to establish fluid pathways and fluxes; Analyse olivine to establish orientations and rates of cooling from trace element profiles (e.g., Ca); Sub-solidus trace element diffusion experiments to improve knowledge of diffusion in olivine.			
Results: Petro-geochemical and isotopic database of magmatic and hydrothermal minerals and whole rocks from the Samail ophiolite; Experimental diffusion rate and closure temperature estimates for trace elements in olivine; *M3, 5, 10, 15 & D3.1, 3.2*.			
Dissemination: At least one publication in a peer-review journal (*M15*); Participation to ABYSS workshops & international conferences, in particular the planned ABYSS EGU & AGU sessions (*M14,17*); Participation to outreach activities organized by Southampton University and ABYSS; SeaRock Blog project.			
Planned secondments: LUH, 4 months (2x60 days), Experimental calibration of Ca-olivine geo-speedometer (2^{nd} and 3^{rd} year); CNRS, 1.5 month (3x15 days), EBSD (1^{st}, 2^{nd} and 3^{rd} years); UIO, 1 month, Diffusion models (3^{rd} year)			
Risk assessment: Geological fieldwork always has an element of risk but these can be minimized by following best field practice, working in teams with appropriate communications, experienced guides, and the rental of field vehicles from reputable companies. The analytical techniques have been successfully used in similar past projects. Required analytical facilities are available in the host and secondments laboratories. Hence the risk is null or minimal.			

ESR6	**UBREM**	**36 months**	**Month 8**
Project title: Replacive formation of massive sulphide deposits: An experimental approach (WP4) Supervisor: ***W. Bach*** – Co-supervisors: Ph. Gouze & M. Godard (CNRS), M. Schanche (NM) PhD enrolment: Y			
Objectives: Replacement of sulphate by sulphide is common in the formation of seafloor massive polymetallic ore bodies. This process is highly non-uniform and affected by poorly understood couplings between the evolution of permeability distribution and sulphate dissolution / sulphide precipitation. The main project objective is to gain insights into these couplings and use the results in improving numerical models of reactive flow.			
Tasks and methodology: Geochemical experiments in flow-through cells under elevated temperatures and pressures; computer microtomography investigation of the spatial and temporal evolution of the distribution of pore space, sulphate and sulphide; geochemical analyses of outflow solutions and thermodynamic calculations of in situ speciation and mineral saturation states; numerical modelling of reactive flow.			

Results: Insights into the rates and mechanisms of replacive sulphide formation with emphasis on permeability evolution. Elucidation of the feedbacks between pore geometry / connectivity, and reaction affinities and rates. Development of properly parameterized numerical models of reactive flow with high predictive power. *M3, 5, 10, 15 & D4.1, 4.2.*
Dissemination: Journal articles, e.g., Chemical Geology, Economic Geology (at least one publication; *M15*); Participation to ABYSS workshops & international conferences, in particular the ABYSS EGU & AGU sessions (*M14,17*); Outreach work in "open door" and "school of rock" activities in Bremen, participation in the SeaRock Blog project.
Planned secondments: CNRS, Year 1 & 2: 2 months per year, Reactive percolation experiments; NM/NTNU: Year 3 1month Field-based ore exploration
Risk assessment: Experimental, analytical, and computational techniques are tested and reliably yield useful results. The handling of sulphide in the conduction of the flow-through experiments can be tricky and dealing with it will receive particular attention early on in the project.

ESR7	**UIO**	**36 months**	**Month 8**
Project title: Mechanical controls on the rate of serpentinization (WP4) Supervisors: ***B. Jamtveit*** & ***H. Austrheim*** – Co-supervisors: Ph. Gouze & M. Godard (CNRS), C. Garrido (CSIC) PhD enrolment: Y			
Objectives: Constrain the extent of brittle deformation in the oceanic crust by reviewing seismological data; Characterize the textent of micro and macrofracturing in incompletely serpentinized oceanic crust; Constrain the coupling between reaction driven stresses and regional stresses for fracturing associated with serpentinization processes by means of numerical modelling			
Tasks and methodology: Seismic, Structural and Petrographic characterization of representative oceanic lithosphere; Construction of numerical model that couple internal stress generation with non-isotropic external stress			
Results: Provide a model of the rates and mechanisms of hydration of the oceanic lithosphere as a function of internal and external/tectonic stress generation; *M3, 5, 10, 15 & D4.1, 4.2*			
Dissemination: 3 papers in international journals (*M15*) and presentations at a minimum of 3 international conferences (including the planned ABYSS EGU & AGU sessions; *M14, 17*); Provide input to popular presentations on the evolution of the oceanic lithosphere via Norwegian Radio and Newspapers; Participation to SeaRock Blog project.			
Planned secondments: CNRS – Years 1 and 2: 6 weeks each year; Benchmarking of experimental and numerical models; CSIC: Year 2: 4 months - EBSD, Stable isotopes			
Risk assessment: All the analytical and technical facilities needed for the realization of this project are available in the host institution and in the secondment hosts.			

ESR8	**CNRS**	**36 months**	**Month 8**
Project title: Hydrothermal fluxes in the mantle lithosphere: Experimental study of the serpentinization and H_2 / CO_2 exchanges (WP4) Supervisors: ***M. Godard*** & ***P. Gouze*** – Co-supervisors : W. Bach (UBREM), C. Garrido (CSIC), B. Jamtveit & H. Austrheim (UIO), C. Fichler & B. Berger (STATOIL) PhD enrolment: Y			
Objectives: Investigate the feed-back effects between hydration reactions and hydrodynamic properties; Characterize their impact on the effective reactivity and sustainability of the system, on hydrogen production and carbon budget.			
Tasks and methodology: Reactive percolation laboratory experiments at P ~20-40MPa & T 150-350°C on olivine, peridotites and serpentinites; Chemical and mineralogical characterization of reaction products and chemistry of outlet fluids (including C); Hydrochemical modelling (in collaboration with ER2)			
Results: Development of a consistent thermodynamic, thermokinetic and hydro-mechanics database to model reaction efficiency in (ultra)mafic hydrothermal systems (including the results of other ABYSS projects; collaborations with ESRs 6, 7, 9 and 10); *M3, 5, 10, 15 & D4.1, 4.2.*			
Dissemination: At least 2 publications in international journals (*M15*); Participation to ABYSS workshops & international conferences, in particular the planned ABYSS EGU & AGU sessions (*M14,17*); Participation to SeaRock Blog project and outreach activities organized in Montpellier and by ABYSS.			
Planned secondments: UBREM Year 1 & 2, 1 month each year, Petrographic analyses & Thermodynamic modelling; CSIC Year 2 & 3, 1 month each year, Mineralogical analyses & Thermodynamic database; UIO Year 2 & 3, 1 month each year, 3D-imaging and numerical modelling; STATOIL, Year 3 1 month, Industrial research on New Energies			
Risk assessment: Experimental, analytical, and computational techniques are tested and reliably yield useful results. All analytical facilities needed for the project are available in the Host Institution and within the ABYSS network.			

ESR9	**CSIC**	**36 months**	**Month 8**
Project title: CO_2 sinks in the oceanic lithosphere: natural constraints on carbonation of ultramafic rocks (WP4) Supervisor: ***C.J. Garrido*** – Co-supervisors : W. Bach (UBREM), B. Ildefonse, M. Godard (CNRS), B. Jamtveit (UIO) PhD enrolment: Y			

Objectives: To investigate natural examples of carbonated serpentinites preserving different stages of carbonation of ultramafic rocks to provide essential insight into the role of serpentinite carbonation in the global carbon cycle; Use natural constrains to develop strategies for in situ mineral carbonation of serpentinite for CO_2 sequestration.
Tasks and methodology: Fieldwork including mapping and sampling of different outcrops worldwide preserving fossil environments of natural carbonation of mafic and ultramafic rocks; Mineralogical, petrological and microstructural characterization by means of different instrumental techniques; Geochemical analyses (laboratory work and instrumental analysis); Thermodynamic and numerical modelling.
Results: Reports on fieldwork and database with petrological and geochemical characterization of samples. ; *M3, 5, 10, 15 & D4.1, 4.2***.**
Dissemination: Submission of at least 1 paper to peer-review journal (*M15*); Participation to ABYSS workshops & international conferences, in particular the ABYSS EGU & AGU sessions (*M14,17*) ; Participation in outreach activities organized by ABYSS and CSIC (including the SeaRock Blog project).
Planned secondments: CNRS, 1st year/1 month; 2nd year/2 months. EBSD and Geochemical analyses; UBREM, 1 month/year 1st, 2nd and 3rd year. Petrography and thermodynamic modelling; UIO, 1 month/year 1st, 2nd and 3rd year. 3D-imaging and numerical modelling.
Risk assessment: Risk exists about the feasibility of fieldwork (access to sampling area, weather, logistics…); selection of several case study outcrops will minimize this risk. All needed analytical facilities are available in the host and secondments laboratories. There is however some risk related to unexpected instrument breakdown, which could be then circumvented by doing the analytical work using similar facilities in other laboratories.

ESR10	**CSIC**	**36 months**	**Month 8**
Project title: Carbonate precipitation in alkaline serpentine-hosted hydrothermal vents (WP4) Supervisors: ***J.M. Garcia-Ruiz*** & ***C. Garrido*** – Co-supervisors: B. Menez (IPGP), W. Bach (UBREM) PhD enrolment: Y			
Objectives: To provide new insights on the kinetics of abiotic magnesium carbonate crystallization in alkaline environments from experiments and observations in natural alkaline environments; To identify potential morphological differences between abiotic versus biotic crystallization in natural alkaline environments.			
Tasks and methodology: Fieldwork and sampling in selected of alkaline environment localities worldwide; Investigation of nucleation and growth of magnesium carbonate using state-of-the-art crystallization and bioprecipitation techniques; Imaging, textural geochemical characterization and thermodynamic modelling.			
Results: Reports on fieldwork and experimental lab. *M3, 5, 10, 15 & D4.1, 4.2*			
Dissemination: Submission of at least 1 paper to peer-review journal (*M15*); Participation to ABYSS workshops & international conferences, in particular the ABYSS EGU & AGU sessions (*M14,17*) ; Participation in outreach activities organized by ABYSS and CSIC (including the SeaRock Blog project).			
Planned secondments: IPGP*, Total of 4 months during the 1st, 2nd and 3rd year. Micro- & nano-imaging, Bioprecipitation experiments; UBREM*, 1st, 2nd and 3rd year/1 month per year. Thermodynamic modelling. (*) Secondments will be scheduled on the basis of project progress and experimental results.			
Risk assessment: The techniques used in this project are robust and have already been successfully used in similar past projects, and all needed analytical facilities are available in the host and secondments laboratories. Some risk exists at field studies due to access to sampling area and weather conditions; we will minimize by selecting of sampling areas. There is also potential risk related to experimental design in laboratory due to the complexity of experiments.			

ESR11	**IPGP**	**36 months**	**Month 8**
Project title: The ocean crust as microbial incubator (WP4) Supervisors: ***B. Menez & E. Gerard***– Co-supervisors: W. Bach (UBREM), D. Brunelli (UNIGE) PhD enrolment: Y			
Objectives: Acquire/develop expertise in high resolution techniques for the search of biosignatures, in situ in oceanic crust samples; Explore the metabolic diversity, energy sources, and biogeochemical transformations of deep ecosystems in the oceanic lithosphere; Develop upscaling models constrained by bioenergetic considerations that aim at predicting biomass production at depth along with its impact on fluid circulations and elemental budgets.			
Tasks and methodology: Selection of samples from past IODP drill cores or dredges rocks along the ridge system (e.g. North Pond, IODP Expedition 336), detailed petrographical analysis and imaging; In situ geochemical analysis of constituent minerals, using EPMA and LA (MC) ICP-MS; In situ organic content characterization using SEM, TEM, µFTIR, µRaman, CLSM, S-DUV, Tof-SIMS; Cell identification using FISH experiments			
Results: Dataset describing the microbial habitants and their habitats in various settings of the oceanic crust; *M3, 5, 10, 15 & D4.1, 4.2*			
Dissemination: At least 1 publication in a peer-review journal (*M15*) and 2 highlights in popular science journals; Participation to ABYSS workshops and international conferences (including the planned ABYSS EGU & AGU sessions (*M14,17*)) and to ABYSS outreach activities (SeaRock Blog project …)			

Planned secondments: UBREM, Year 1 and 2, 1.5 month each year: Petrographic analyses, Thermodynamics, Modelling; UNIGE, Year 1 and 2, 1.5 month each year: Petrographic imaging/analyses - LA (MC) ICP-MS
Risk assessment: The techniques used in this project have already been successfully used in past projects targeting serpentinized and basaltic environments. Nonetheless, a complete success will depend on the synchrotron beamtime availability (Cooperation agreements in progress). Microbial ecology is the more risky part as those techniques are hardly implemented on hard rock samples but do not constitute the core of the work.

ESR12	**NTNU**	**36 months**	**Month 8**
Project title: Geophysical expression of serpentinites: Mapping the reactions that produce magnetic minerals and developing exploration tools for potential economic deposits (WP4) Supervisors: ***S. McEnroe*** & ***C. Fichler*** *(STATOIL)* – Co-supervisor: T. Henstock (USOTON) PhD enrolment: Y			
Objectives: Develop geophysical tools for mapping ultramafic rocks tied to deposits; measure high- and low-temperature magnetic properties of serpentines and associated rocks; microscopic observation & analyses of oxides; identify processes that create or destroy magnetic minerals related to serpentinites; integrate geophysical (magnetic, seismic, gravity, etc.) and geological data (geochemistry, tectonics, etc.) with the physical properties to map serpentinization reactions.			
Tasks and methodology: Fieldwork collecting oriented and unoriented samples, and ground magnetic mapping; Microscopic observation using reflected light microscope, SEM and EMP for chemical/mineral analyses; Geophysical data integration and interpretation, e.g., magnetic, gravity and seismics (offshore)			
Results: Magnetic properties data, geophysical interpretations. *M3, 5, 10, 15 & D4.1, 4.2*			
Dissemination: 3 publications are planned (*M15*); Participation to ABYSS workshops & international conferences, in particular the planned ABYSS EGU & AGU sessions (*M14, M17*); Participation to SeaRock Blog project and outreach activities organized by NTNU and ABYSS.			
Planned secondments: STATOIL: Fellow will have use of geophysical facilities and database, software and interaction with Statoil personnel 1st year/3 months, geophysical interpretation; 2nd year/3 months, geophysical model refinement. USOTON: 1 month Flow transport models.			
Risk assessment: The magnetic measurements techniques are standard and access to commercial and research software for modelling at NTNU and Statoil is excellent. Analytical facilities are available at the host and through cooperation partners. The main potential risk is related fieldwork. This is accounted for by strict NTNU safety procedures.			

ER1	**NTNU**	**20 months**	**Month 15**
Project title: Importance of pre-emplacement processes upon economically fertile mafic melts (WP3) Supervisors: ***R. Berg-Edland Larsen, S. McEnroe & M. Schanche*** *(NM)* PhD enrolment: N			
Objectives: Develop refined exploration models and methods for future discoveries of unexposed and exposed onshore and offshore ore-deposits. Unravelling positive and negative economic fertilization of mantle derived igneous melts during their ascent through oceanic and continental lithospheric segments.			
Tasks and methodology: Fieldwork Seiland Province, Northern Norway & Combined interpretation geophysical and geological data; Petrography, major- and trace element analysis: microscopic observation of oxides and EMP analyses, geochemical, petrophysical and magnetic properties of key minerals; Stable and radiogenic isotope systematics: Stable isotope analysis of sulphides and oxides, Radiogenic isotope analysis whole rock and mineral separates.			
Results: Develop refined exploration models based on combined geochemical and magnetic data; *M7, 9, 15 & D3.1, 3.2.*			
Dissemination: 2 publications are planned in peer-reviewed international journals (*M15*); Participation to ABYSS workshops, to at least one international conference and to ABYSS outreach activities (SeaRock Blog project …)			
Planned secondment: NM: 4 months (2x60 days) Field based ore exploration and exploitation			
Risk assessment: Techniques used are standard. Analytical facilities are available at the host and through cooperation partners. The main potential risk is related to fieldwork. This is accounted for by strict NTNU HES procedures.			

ER2	**CNRS**	**24 months**	**Month 20**
Project title: Multi-scalar modelling of hydrothermal fluxes in the mantle lithosphere (WP4) Supervisors: ***Ph. Gouze*** & ***M. Godard*** – Co-supervisors: V. Hebert & O. Rodriguez (co-founders of VOXAYA), B. Jamtveit & A. Malthe-Sorenssen (UIO), T. Henstock (USOTON), W. Bach (UBREM) PhD enrolment: N			
Objectives: Investigate the control of pore scale properties and reaction-induced mass transfers on fluid hydrodynamics; Application to modelling of reactive fluid flow in hydrated mantle lithosphere			

Tasks and methodology: Development of specific data processing and pore scale mass transfer modelling, in collaboration with the incubated start-up VOXAYA; Processing μtomographic images of experimental and natural samples to determine pore scale structure and hydrodynamic properties of reacted samples with other ABYSS projects (mainly ESRs 6, 7, 8 and 9); Hydrochemical modelling from Stokes to Darcy scale
Results: Acquisition of a set of pore-scale modelling approaches allowing predicting the effects of the coupling of chemical, mechanical and hydrodynamic properties in porous reactive media; Benchmark database for comparison, through upscaling studies, to reactive-transport porous flow models. *M7, 9, 15 & D4.1, 4.2.*
Dissemination: At least one publication in a scientific journal (*M15*); Participation to ABYSS workshops and to international conferences (EGU, AGU and/or Goldschmidt conferences); Participation to SeaRock Blog project and outreach activities organized in ABYSS.
Planned secondments: UIO: Year 1: 2 months 3D-imaging & numerical modelling; UBREM Year 1 & 2, 1 month/year, Petrographic and mineralogical analyses, Thermodynamics
Risk assessment: The analytical facilities and knowledge needed for the project are available in the Host and secondment Institutions.

ER3	**USOTON**	**24 months**	**Month 20**
Project title: Calibration of isotopic tracers to determine water-rock interactions: an experimental approach (WP4) Supervisors: ***D. Teagle (USOTON) & M. Godard (CNRS)*** – Co-supervisors: Ph. Gouze (CNRS), B. Jamtveit (UIO), W. Bach (UBREM) PhD enrolment: N			
Objectives: To test and calibrate models of deep crustal mineral-fluid exchange; To better understand the mechanisms of hydrothermal fluid-rock chemical exchange at mid-ocean ridges; Improve estimates of ocean ridge fluid fluxes			
Tasks and methodology: Specifically designed reactive percolation experiments, using isotopically labelled (e.g., Sr, Mg, O, H, C) hydrothermal fluids and seawater injected into lower crustal and mantle rock analogues at appropriate temperatures; Geochemical and isotopic analyses of fluids and secondary minerals; Develop improved reactive tracer transport models including the calculation of time integrated fluid fluxes			
Results: Geochemical and isotopic analyses of primary and secondary minerals from experimental charges and the associated reaction fluids; Improved reactive tracer transport models for the lower oceanic crust; *M7, 9, 15 & D4.1, 4.2.*			
Dissemination: At least one publication in a peer-review journal (*M15*); Participation to ABYSS workshops and to international conferences (EGU, AGU and/or Goldschmidt conferences). Participation to outreach activities organized in ABYSS (SeaRock Blog…) and by the University of Southampton.			
Planned secondments: CNRS, 5 months (30 days+2x60 days), Definition of isotope protocol & Reactive percolation experiments; UBREM, 1 month (2x15 days), Petrographic and mineralogical analyses, Thermodynamics			
Risk assessment: The analytical and experimental techniques have already been successfully used in similar past projects. All required facilities are available in the host and secondments laboratories. Nevertheless the project includes the development of a new experimental protocol for isotopic monitoring. In case of failure, this part of the project will be refocused on experiments dedicated to geochemical and trace element monitoring, using an already tested methodology.			

B.4.3. Management structure, organisation and procedures

B.4.3.1. Network organization and management structure[2]

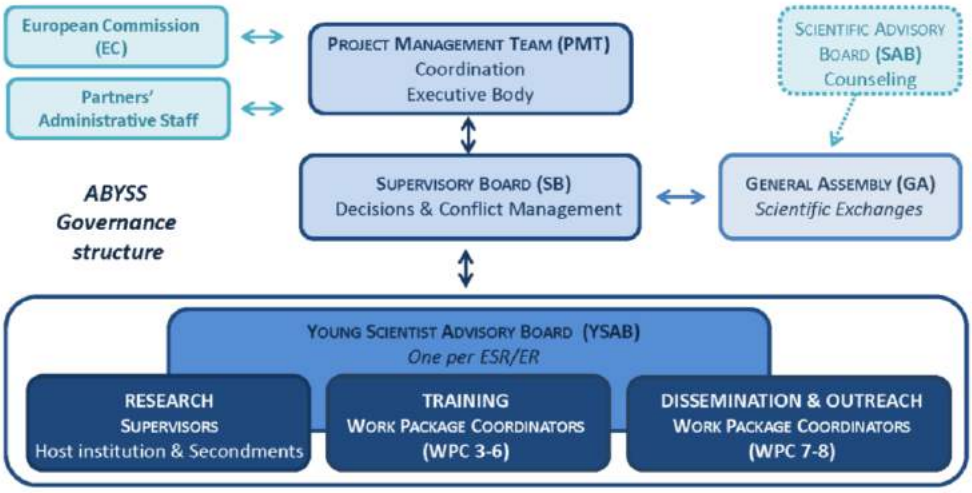
ABYSS will be governed by the organizational structure represented in the following figure. This governance structure shall be set up in the Consortium Agreement to be signed by all Participants and Associated Partners.

The **Supervisory Board (SB)** is the decision-making body governing the network. It is composed of one representative of each partner organisation in the project, each with voting right. Trainees (ESRs/ERs) will have two representatives to the SB, elected yearly, but without voting rights. The **Scientific Coordinator (CO)**, Marguerite Godard, will chair all SB meetings. SB meetings will be held every 6 months on ordinary sessions and, when requested, on extraordinary sessions. Voting rules will be: the SB may not deliberate over

[2] If any of the persons mentioned in Annex I is unable to participate in the project, he/she will be replaced by someone with the same level of experience and/or expertise

and vote unless 2/3 of its members are present or represented at the meeting and decisions will be taken by a majority of 2/3 of the votes. The SB will be the competent body to deliberate over:
→ the monitoring of the project (overall management of the network, ensuring adequate logistical help is provided to ESRs/ERs for secondments, actuation of the training programme, global assessment of the research activities of the network, composition of the Scientific Advisory Board, WPCs, …);
→ content, finances and intellectual property rights (reporting to the European Commission (EC), propositions for changes to the Consortium Plan (including the Consortium Budget), modifications to Access Rights granted to Background; contingency planning, etc.);
→ changes in the Consortium (entry or withdrawal of a partner; conflict resolution and settlement of disputes; change of Scientific Coordinator; changes in the ESRs and ERs, etc.).

At the operational and executive level, the **Project Management Team (PMT)** will be in charge of the management of the project. It is responsible for the internal organisation and the implementation of the network activities. The PMT is the interlocutor of the Administrative Staff of the participating organisations and of the EC services. It acts as an intermediary between the EC and the Supervisory Board. It is composed of the **Scientific Coordinator (CO)**, the **European Project Manager (EPM)** and all relevant CNRS support offices. The EPM will assist the Scientific Coordinator, Marguerite Godard, in her coordination role and (s)he will be in charge of the day-to-day administrative and financial management. The EPM, familiar with project coordination techniques and European procedures, will be **recruited over the project duration on a part-time basis (50%)**. Finally the CNRS Languedoc-Roussillon Regional Office will provide assistance to both the CO and the EPM on all financial, administrative, legal and, should they arise, IPR matters.



The **General Assembly (GA)** includes all scientists directly involved in the project: senior scientists (whether members of the SB or not), ESRs and ERs. The main scientific outputs and the work progress of the young researchers will be discussed during the project meetings/workshops that will take place every 6 months (see *Table 2*).

Work Package Coordinators (WPC) will organize the activities developed within each WP (*Table 1*, Section B2.2). WPC are appointed according to their scientific expertise and previous project management experience. They will regularly report on the progress of their WP to the GA.

Each trainee will be monitored by his/her **Young Scientist Advisory Board (YSAB)**, composed of at least 4 members : his/her supervisor(s) at his/her Host Institution and at secondment places, a WPC and one of the ABYSS senior scientists, not directly involved in the ER/ESR project. The YSAB will help the young researcher establish his/her Personal Career Development Plan (PCDP) at the beginning of the fellowship (D6.1, D6.2) then, over the fellowship period to monitor the progress made but also, if necessary, to update the PCDP according to the acquired skills and knowledge and the potential career opportunities which could

emerge. Of particular importance for the ESR projects, will be the evaluation one year after the beginning of the project, of the progress of research and training programme (M10). The ESR will be required to write a short individual report on the progress of his/her project with regard to his/her PCDP and present it to the YSAB and the SB (*Table 5*), who will decide whether the candidate is eligible to continue in the programme or not, taking into account the YSAB recommendations (D3.1, D4.1, D6.3). Close tutoring and monitoring will guarantee a highly qualified and sensible follow-up of the fellows' work progress and career plan development. At the end of the contract, the YSAB will also meet with the fellow to evaluate the training, discuss his/her future plans/perspectives, and help in his/her integration in the professional world.

The **Scientific Advisory Board (SAB)** is mainly composed of visiting scientists, with an outstanding expertise in the research domains at the core of the project. Their missions to the benefit of the young researchers are to provide lectures during the network workshops / short courses; to give external recommendations and advices on some strategic research issues; and to strengthen and enlarge the career development perspectives of the recruited fellows. They will be invited to participate to the yearly ABYSS workshops. Amongst the visiting scientists of the SAB: M. Andreani (mineralogy, lab- and field-based approaches on serpentinization; ENS-Univ. Lyon), G. Fruh-Green (Geochemist, (Bio-)geochemical hydrothermal processes; ETH, Zurich, Switzerland), M. Bickle (numerical Earth scientist, fluid dynamics & hydrothermal fluxes, U. Cambridge, UK); P. Kelemen (Petrologist, mantle dynamics, CO_2 sequestration; LDEO, Columbia Univ., USA); R. Tribuzio (Petrologist, magmatic processes, ophiolites, U. Pavia, Italy).

ABYSS will have an active policy of networking and communication of the results of its research and training programme, during the project duration and after completion of the contract, through its website, the organization of meetings (from project meetings to workshops) and participation to international conferences, scientific publications.

○ The **ABYSS website** will be implemented on Month 2. It will be composed of an *intranet platform* with restricted access (D1.1), on which all documentation related to administrative and financial issues, management, progress reports, etc. will be at the disposal of the network members. The public pages of the website will provide a description of the objectives, composition and contact data of the network and will serve as an important dissemination tool (D7.1): publication of offered positions, the list of the network scientific publications, specific events, etc. The EPM will be in charge of maintaining this website.

○ **Project meetings and workshops** (General Assembly), **management meetings** (Supervisory Board), **training meetings** (short-schools) and **YSAB meetings** will be regularly organized (see *Table 5* and *Appendix 1: Gantt Chart*). These meetings will be scheduled roughly every 6 months and take place at the same dates to rationalise expenses and limit travels, thus giving the opportunity to all scientists to meet regularly over periods from 3 to 10 days. Together with secondments and informal visits, these meetings will provide a high level of interactions that should allow a smooth internal communication between the network members and dynamic training and research collaborations, two basic ingredients of scientific excellence.

Moreover, a mid-term review meeting will be organised at month 20 of the project (see Appendix 1), according to the Special Clause 5 bis of Article 7 of the Grant Agreement. The venue and organisation of this meeting will be of the responsibility of the coordinator, and the timing and location of the meeting must be agreed with the REA project officer.

Table 5. Management activities

	Management activities	Lead Organising Institution	Planned date	Planned location	Planned duration	Participants[3]
1	Kick-off meeting (**M1, M2**)	CNRS	Month 1	Montpellier (France)	2-3 days	GA, SB
2	Supervisory Board meeting 1 (coordinated with First ABYSS Workshop, See Table 2)	CNRS	Month 8	Montpellier (France)	0.5 day	SB
3	Establishment of PCDP for each ESR (coordinated with First ABYSS Workshop – See Table 2) (**M5,** D6.1)	CNRS	Month 8	Montpellier (France)	0.5 day	ESRs, YSABs
4	Supervisory Board meeting 2 (coordinated with Project Mid-Term Meeting 1, See Table 2)	UBREM	Month 17	Bremen (Germany)	0.5 day	SB
5	PCDP progress meetings (coordinated with Project Mid-Term Meeting 1, See Table 2)	UBREM	Month 17	Bremen (Germany)	0.5 day[4]	ESRs/ERs, YSABs
6	Supervisory Board meeting 3 (coordinated with 2nd ABYSS Workshop – See Table 2)	IPGP	Month 20	Paris (France)	0.5 day	SB
7	ESRs PCDP "mid-term" review meetings (coordinated with 2nd ABYSS Workshop, See Table 2): decisions and recommendations for the continuation of training & research programme (**M10,** *D3.1*, *D4.1*, *D6.3*)	IPGP	Month 20	Paris (France)	1 day[5]	ESRs, YSABs, SB
8	Establishment of PCDP for ERs (**M9,** *D6.2*)	IPGP	Month 20	Paris (France)	0.5 day	ERs, YSABs
9	Supervisory Board meeting 4 (coordinated with Project Mid-Term Meeting 2, See Table 2)	UNIGE/UNIMI	Month 26	Genova/Milano (Italy)	0.5 day	SB
10	PCDP progress meetings (coordinated with Project Mid-Term Meeting 2, See Table 2)	UNIGE/UNIMI	Month 29	Genova/Milano (Italy)	0.5 day[4]	ESRs/ERs, YSABs
11	Supervisory Board meeting 5 (coordinated with 3rd ABYSS Workshop – See Table 2)	UIO	Month 32	Oslo (Norway)	0.5 day	SB
12	PCDP progress meetings (coordinated with 3rd ABYSS Workshop, See Table 2)	UIO	Month 32	Oslo (Norway)	0.5 day[4]	ESRs/ERs, YSABs
13	Supervisory Board meeting 6 (coordinated with Project Mid-Term Meeting 3, See Table 2)	CSIC	Month 38	Granada (Spain)	0.5 day	SB
14	PCDP progress meetings (coordinated with Project Mid-Term Meeting 3, See Table 2)	CSIC	Month 38	Granada (Spain)	0.5 day	ESRs/ERs, YSABs
15	Supervisory Board meeting 7 (coordinated with last ABYSS Workshop – See Table 2)	USOTON	Month 44	Southampton (UK)	0.5 day	SB
16	PCDP review meeting (coordinated with last ABYSS Workshop, See Table 2) : Final evaluation based on the review of Individual Reports & YSAB comments (**M15**, *D3.2*, *D4.2*, *D6.5*)	USOTON	Month 44	Southampton (UK)	0.5-1 day	ESRs/ERs, YSABs, GA
17	Final meeting : assessment of the results of the project (**M18**, *D1.4*)	CNRS	Month 48	Montpellier (France)	2-3 days	GA

B.4.3.2. Financial management

The implementation of the financial strategy relies on the PMT and will be daily administered by the EPM. It shall be described in the **Consortium Agreement (CA)** to be signed and directly available on the Intranet platform of the ABYSS website.

[3] GA = General Assembly (i.e. ESR/ER, Full and Associated Partners) ; SB = Supervisory Board; YSAB = Young Scientist Advisory Board

[4] The individual PCDP progress meetings will be organized as 1-2h "break-out sessions" coordinated by the YSAB.

[5] A short synthesis of the results of individual PCDP progress meetings will be presented to and discussed by the SB at the end of the day.

The coordinator CNRS will transfer funds to partner organisations to cover their eligible expenses in conformity with the FP7 Guide to Financial Issues. Each Full Participant is entitled to sign the Grant Agreement and therefore be directly granted a part of the total EC contribution. In this context, fellows are to be employed by their Host Institutions on contracts consistent with national and EU regulations. Such contracts will provide both the living and mobility allowances. Costs for training visits at other sites (secondments) and participation to the cost of short-courses, science meetings and workshops, will also be funded by the Host Institution, in order to avoid that partners, who are more involved in offering secondment places and in organizing events, are financially disadvantaged. Training and workshop budgets will be discussed at SB meetings.

Management costs will be principally supported by CNRS. Most of the management funding shall thus be held centrally in order to pay management personal costs (for the EPM and the time dedicated to this activity by the Scientific Coordinator); travel costs for the PMT and the Associated Partners attending the SB and travel costs for SAB meetings; and the production of management tools and common outreach material such as the website(s). A part of the management funding shall also be distributed to each Full partner to enable its members to directly cover management-related expenses such as travel costs to attend the SB meetings, audit certification costs, etc.

In ABYSS Project, CNRS represents the following Joint Research Unit (and will be the only entity which will claim costs and submit a Form C):

- **UMR5243 – Géosciences Montpellier - Unité mixte CNRS / Université de Montpellier 2.**

The CNRS Languedoc-Roussillon Regional Delegation will be the lead Delegation legally responsible for the CNRS Unit involved in the Project.

B.4.3.3. Recruitment strategy

The recruitment strategy will be developed within ***WP2. Recruitment*** under the lead of the ABYSS coordinator, in close collaboration with the respective Host Institutions and in conformity with the guidelines of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers.

The EPM will be in charge of designing the fellowship advertisements, of posting them on all appropriate channels and websites (including Euraxess, EOS Newsletter; European Geosciences Union Job website), of coordinating the job interviews by the Host Institutions (by providing these panels of interviewers with guidelines and strictly enforcing the Marie Curie ITN mobility criteria), etc. Fellows will be hired on a full-time basis with full social security coverage and recruitments will be formalised at months 8 to 10 of the project for ESRs – in line with the academic agenda. The timing of recruitment of ERs will be more flexible. The time line will be adapted to the project: for instance, ER1 project will need to begin by field work in Northern Europe, and therefore should begin in Spring. Also, this flexibility should allow the recruitment of the best possible candidate: it is expected that for these highly specialized positions the recruitment of a young researcher with the right skills and knowledge, an interest in the subject, and fitting the EU ITN Action eligibility criteria of no more than 5 years of research experience could be challenging. However, every effort will be made so that recruitment takes place before Month 24 to maximize interactions with ESRs.

Special attention will be paid to the best implementation of equal opportunities principles. All positions should introduce flexible working hours and provide adequate timing for secondments. At the end of the recruitment process, unsuccessful applicants will be addressed an official letter stating the recruitment guidelines and the reason(s) why their applications have not been chosen.

The criteria of excellence will be at the core of these guidelines: applicants will be selected on their ability to carry out the IRPs in fixed delays, their potential for scientific excellence, their maturity and adaptability to work in a multicultural environment, and the potential added-value of the training programme

on their future career. Applicants will thus have to show curiosity for diverse research activities as well as interest in the opportunity to work during secondments and/or after their fellowship for the private sector.

B.4.3.4. Gender aspects

Considerations of gender issues should be taken into account, both at the recruitment stage (equal opportunities principles) and during the employment period (flexible working time and implementation of secondments).

B.4.3.5. Intellectual property

The management of Intellectual Property Rights (IPR) will be described in the CA to be signed at the beginning of the project. The ABYSS partners have identified the essential role that IPR play in the development and application of science today, specifically for knowledge transfer from academia to industry. The consortium will be organised to protect the technology it could develop whilst making it available through open access as often as possible. Confidentiality rules and issues on Foreground and Access Rights will be defined in the CA, in line with the following principles. The Foreground is defined as the knowledge/skills/discoveries stemming from the project. This should be the property of the partner organisation(s) having carried out the work, meaning that either individual or joint ownership may apply to a specific result. Where such a result leads to an industrial or commercial application, the result owner will be in charge of providing the adequate protection (patent or copyright). Any exploitation by a co-owner of a joint Foreground should be subject to prior consent of the other co-owner(s), with possibly financial compensation in return. Owners of IPR shall be assisted by their local offices for valorisation of research, for drafting legal arrangements and other legal issues.

B.4.3.6. Subcontracting

Except for audit certification, no subcontracting is expected.

B.4.3.7. Third parties (other than subcontractors)

Not applicable.

B.4.3.8. Consortium Agreement

Although the conclusion of a Consortium Agreement (CA) is not mandatory for a Multi-ITN project, the ABYSS partners commit themselves to sign such an agreement at the beginning of the project (Month 3). This CA shall further describe the management structure and procedures, the financial management and the strategy of dissemination and exploitation of results, which may arise from the project.

B.4.4. Project monitoring and key performance indicators

Periodic and final reports are contractual deliverables, according to Article 4 and II.4 of the Grant Agreement. In addition, progress reports are due at the end of the first and third year in order for the REA to monitor the implementation of the project. When preparing those documents, the coordinator should report according to the following key performance indicators and specify the means to monitor them.

B.4.4.1. Research Activities

- Research results obtained (including a short description of progress on the individual projects) and deviations, if any, to the original research work plan.
- Scientific highlights and achievements (scientific/technological breakthrough, patents, awards, prizes etc...).
- A full list of individual and joint publications, directly related to the work undertaken within the project (including citation index and impact factor), with appropriate acknowledgment of the funding source.

- Intersectoral and multidisciplinary collaboration.

B.4.4.2. Training Activities

- Implemented training events/activities and deviations, if any, to the original training plan (including Career Development Plans, coaching or mentoring activities in place at each Host Institution).
- Participation of the fellows in training events and meetings from the network (workshops, seminars, summer schools, etc), and at international conferences outside the network (names, places, dates).
- Transferable skills training (e.g. project management, presentation skills, language courses, ethics, intellectual property rights, communication, entrepreneurship, etc.).
- Implementation of visits/secondments undertaken within the network to both full participants and associated partners.

B.4.4.3. Management activities

- Status of ESR/ER recruitments at each participant, and relevant issues related to the recruitment strategy/process and gender balance, with justification for any deviation from the original plan.
- Effectiveness of networking, communication and decision-making between stakeholders.
- Effectiveness of the "training events and conferences": external participation and integration in the training programme.
- Effectiveness of the financial management and compliance with Marie Curie salary rates.
- IPR management and commercial exploitation of research results.

B.4.4.4. Dissemination and outreach activities

- Implementation and analysis of the proposed outreach activities and deviations, if any, to the original work plan.
- Analysis of the dissemination activities.

B.5 Impact

B.5.1. Impact towards the policy objectives of the programme

ABYSS is a **coherent career-development platform for young scientists** focusing on geodynamic processes under the seafloor and their environmental and economic impacts. It aims to **provide to the ESRs and ERs the scientific and technical knowledge, the networking and the management and communication skills and expertise, to allow them to find employment in decision-making positions, whether in research in academia or in R&D, industry or in (inter)governmental agencies.** ABYSS builds on a pluridisciplinary consortium involving Research Institutions and Private Sector companies from across Europe, with broad and complementary expertise and scientific interests. It is organized as a structured and extensive programme combining IRPs, common short courses and workshops, student exchanges, and synergistic activities with a strong focus on communication towards the general public. Well-defined deliverables will allow assessing the progress and impact of the project (*Table 5*). More particularly, the **publication of scientific articles** by the ERs and ESRs and their **participation to the international scientific events and to the outreach activities** organized by ABYSS, will be **measurable criteria indicating that the programme has reached its research, training and dissemination objectives and will have a long-term impact** (Section B.3.1).

An important milestone of the ESR projects will be the evaluation, one year after the beginning of their IRP (M10), of the progress of research and training programme with regard to the ESRs' PCDPs (Section B.4.3.1). An individual scientific report, including at least one publication submitted to a scientific journal, will be required 3 months before the end of the project of each ER and ESR (M15). For ESRs, this report will be (a draft of) the PhD thesis. The Individual Scientific Report will be reviewed by a senior scientist participating to the project and, for ERs, an external expert. The revised version of the Individual Scientific Reports (including comments and recommendations of YSAB & Experts) will represent the final deliverable of each ER/ESR project and will be summarized in the final results of the ABYSS research and training programme (D6.5; D1.4).

The progress of the project will be evaluated on a regular basis for each WP (D2.3, D3.1, D4.1, D5.4 & D5.7, D6.3 & D6.4, 7.2, 8.2) and summarized in intermediate reports (D1.2, D1.3). The success of the project will be assessed mainly on the basis of *(i)* the evaluated Individual Scientific Reports and PCDP (M15, D3.2, D4.2 & D6.5), *(ii)* the participation of the ESRs and ERs to the two specialized sessions organized by the ITN in the two major conferences in Earth's sciences and to the last ABYSS workshop (M14, M15, M17, D7.3 & D7.4), *(iii)* the individual publications and the review scientific article summarizing these published results (D7.5 & D7.6), *(iv)* the participation to and impact of the *SeaRock Blog* project (D8.3).

Table 6. List of Deliverables per Work Package

Deliv. No.	**Deliverables (Lead Participant /** *Other Participants*)	**Nature/ Dissemi-nation[6]**	**Month**
D1.1	ABYSS Intranet (**CNRS**, *MERI*)	O / CO	2
D1.2	Initial Report: 1st evaluation of functioning of the ITN, recommendations (**CNRS,** *ALL*)	R / CO	10
D1.3	Intermediate Reports: Assessment of Management; Progress, recommendations, contingencies per ESR/ER, WP & for the project (**CNRS,** *ALL*)	R / RE	24, 36
D1.4	Final Report: Scientific Results, Evaluation of Training Programme and Impact of the Project	R / PU	48

[6] Nature : R (Report), E (Event), P (Publication), O (Other) / Dissemination level: PU = Public; RE = Restricted to a group specified by the consortium; CO = Confidential, only for members of the consortium (including the Commission Services).

	(**CNRS,** *ALL*)		
D2.1	ESR employment contracts (**CNRS,** *ALL*)	O / CO	8
D2.2	ER employment contracts (**CNRS,** *NTNU, USOTON*)	O / CO	20
D2.3	Evaluation: recruitment strategy, adequacy to EU equal opportunities & open competition criteria (**CNRS,** *ALL*)	R / PU	24
D3.1	ESR Progress Reports: Individual Reports, Assessment & Recommendations (**UNIGE,** *ALL*)	R / CO	20
D3.2	ESR/ER Final Reports: Revised Individual Scientific Reports, Research & Training Synthesis (**UNIGE,** *ALL*)	R / PU	44
D4.1	ESR Progress Reports: Individual Reports, Assessment & Recommendations (**UBREM,** *ALL*)	R / CO	20
D4.2	ESR/ER Final Reports: Revised Individual Scientific Reports, Research & Training Synthesis (**UBREM,** *ALL*)	R / PU	44
D5.1	SC1 Formation and evolution of the Ocean Crust (**USOTON,** *ALL*)	E / RE	15
D5.2	SC2 The oceanic lithosphere: State of the art of research and marine exploration techniques (**UBREM,** *ALL*)	E / RE	17
D5.3	SC3 Advances in imaging and analytical techniques for (bio)petrology (**IPGP,** *ALL*)	E / RE	20
D5.4	Progress report: Questionnaires on SC1, SC2, SC3 (ESR/ER/organizers): Evaluation, recommendations (**UNIMI,** *ALL*)	R / CO	21
D5.5	SC4 Experimentation in geology (**UNIMI, LUH,** *ALL*)	E / RE	26
D5.6	SC5 The coupling between chemical reactions and mechanical processes (**UIO,** *ALL*)	E / RE	29
D5.7	Final Report: Questionnaires, Impact of training; Recommendations (**UNIMI,** *ALL*)	R / RE	30
D6.1	Establishment of PCDP for each ESR (**NTNU,** *ALL*)	O / CO	8
D6.2	Establishment of PCDP for each ER (**NTNU,** *ALL*)	O / CO	20
D6.3	Summary of decisions and recommendations of YSAB for the continuation of training & research programme of each ESR project (**NTNU,** *ALL*)	R / CO	21
D6.4	Mid-project evaluation: Assessment of level of satisfaction of the Trainees: Compilation of Questionnaire, Recommendations (**NTNU,** *ALL*)	R / CO	26
D6.5	Assessment of fulfilment of PCDP for each ESR & ER: Synthesis of Individual Reports & YSAB comments (**NTNU,** *ALL*)	R / CO	44
D7.1	Webpage & Brochure (**CNRS, MERI**)	O / PU	2
D7.2	Progress report: ESR/ER participation to conferences and articles' publication, recommendations (**CSIC,** *ALL*)	R / CO	26
D7.3	ESR/ER presentations at European Geosciences Union Annual Meeting (**CSIC,** *ALL*)	E / PU	38
D7.4	ESR/ER presentations at American Geophysical Union Fall Meeting (**CNRS,** *ALL*)	E / PU	46
D7.5	Review paper summarizing the published main scientific results of the project (**CNRS,** *ALL*)	P / PU	48
D7.6	Final report: evaluation of ESR/ER participation to conferences and articles' publication, impact (**CSIC,** *ALL*)	R / PU	48
D8.1	Participation of ABYSS ESRs/ERs to "La fête de la Science" – Paris France (**IPGP,** *ALL*)	E / PU	20
D8.2	Progress report: ESR/ER participation to outreach activities (incl. SeaRock Blog Project): Assessment, Recommendations (**IPGP, MERI,** *ALL*)	R / CO	32
D8.3	Final report: Impact of outreach activities incl. the SeaRock Blog Project (**IPGP,** *ALL)*	R / PU	48

These criteria will indicate that the ESRs/ERs have acquired the scientific and technical knowledge, the management and communication skills and expertise, and benefited from the ABYSS and external networking, that will allow them to find employment in decision-making positions, whether in research in academia or in R&D, industry or in (inter)governmental agencies.

B.5.2. Plans for exploitation of results and Dissemination strategy

Participation to international conferences/workshops and publication of articles will constitute the main dissemination channels for ABYSS (WP7). ESRs/ERs will be encouraged to communicate their

results in international conferences/workshops. In addition, the ABYSS programme will organize : (i) **two sessions in international conferences on the network research themes** (M14 - European Geosciences Union Annual Meeting; M17 - American Geophysical Union Fall Meeting), to which all ESRs/ERs shall participate (D7.3; D7.4) and (ii) the **4th ABYSS workshop** (M16; Section B.3.2), that will be open to a large number of external participants, to ensure a wide dissemination of the outcomes of ABYSS research and training programme in the international community. The publication of an article in an international scientific review is the most commonly recognized indicator of success of a research project in Geosciences. All ESRs/ERs will be required to submit at least one scientific article before the end of their contract (M15). All academic partners have outstanding records in international, peer reviewed, scientific journals, such as Earth Planetary Science Letters, Geochimica et Cosmochimica Acta, Journal of Geophysical Research, Chemical Geology and Nature. Senior scientists will make their best efforts to help the fellows present and publish their results in adequate time and place.

As required by Annex II of the grant agreement, the coordinator should ensure that all publications and presentations by members of the project consortium - including all funded fellows - acknowledge the EU financial support received. This acknowledgement should specifically refer to the Marie Curie Initial Training Networks (ITN) action, as well as the project number and acronym.

B.5.3. Outreach activities

Outreach and Scientific communication toward the general public is an essential part of ABYSS. ESRs/ERs are expected to actively participate in the outreach activities organized by the project (see below), and to address other dissemination channels, including possibly giving TV/web/press interviews. Through these channels, the young researchers are expected to act as the network ambassadors: each article release and external communication shall refer to both the project and network and to the Marie Curie ITN funding. The objectives of these activities are to communicate and promote the research at the centre of the ABYSS project, but also to raise the awareness of the general public and of policy makers for Geosciences "under the seafloor", and more broadly for far-offshore deep sea research and their environmental and economic consequences. To reach these communication objectives, the ABYSS project will greatly benefit from the participation and counselling of MERI.

Two practical **outreach activities will be organized specifically as part of the ABYSS outreach programme** (**WP8**).

○ ABYSS at **"La fête de la Science" – Paris France**. The dates of the 2nd ABYSS workshop and of Short Course 3 will be chosen to overlap with this French outreach event organized every year at the same period by the French Ministry of Research to promote and communicate on science and research. The trainees will be encouraged to realize and present a pedagogical outreach project on Marine Geosciences. The project will be also a team building exercise, and facilitate personal interactions within the network and thus favour research collaborations.

○ The **SeaRock Blog Project** will be a student driven project in which the ESRs/ERs will present, post and discuss their own project and/or the rationale and objective of ABYSS and /or more generally on deep sea research. The SeaRock Blog will be independent from the ABYSS website, and will be self-managed by the ESRs/ERs. The trainees will design the site, and define the editorial lines. A new managerial team of 3 trainees will be designated every 6 months; its role will be to maintain the blog and give a progress report/presentation to the network participants. Training (basic webpage development & design, website management) and early supervision will be provided by MERI. A Moderating Board comprising 3 moderators (chosen among the senior scientists) will supervise the postings. MERI will provide the professional expertise in outreach and communication toward both the research communities and the general public and policy makers.

B.6 Ethical issues

The Beneficiaries accept to uphold the highest standards of scientific integrity and ethical conduct during the implementation of the grant agreement.

PART C:

Overall indicative project deliverables

A3.1:
Overall Indicative Project Deliverables

Project Number [1]	608001	Project Acronym [2]	ABYSS

One Form per Project

	Initial Training 0-5 years						Total
	Early-Stage researchers			Experienced researchers			
	Months	Researchers	% Fixed amount contract (B)	Months	Researchers	% Fixed amount contract (B)	Months
CNRS	72	2	0%	24	1	0%	96
CSIC	72	2	0%	0	0	0%	72
USOTON	36	1	0%	24	1	0%	60
UBREM	36	1	0%	0	0	0%	36
IPGP	36	1	0%	0	0	0%	36
UNIMI	36	1	0%	0	0	0%	36
UNIGE	36	1	0%	0	0	0%	36
LUH	36	1	0%	0	0	0%	36
UIO	36	1	0%	0	0	0%	36
NTNU	36	1	0%	20	1	0%	56
Overall Total	432	12	0%	68	3	0%	500

PART D:

Overall maximum EU contribution

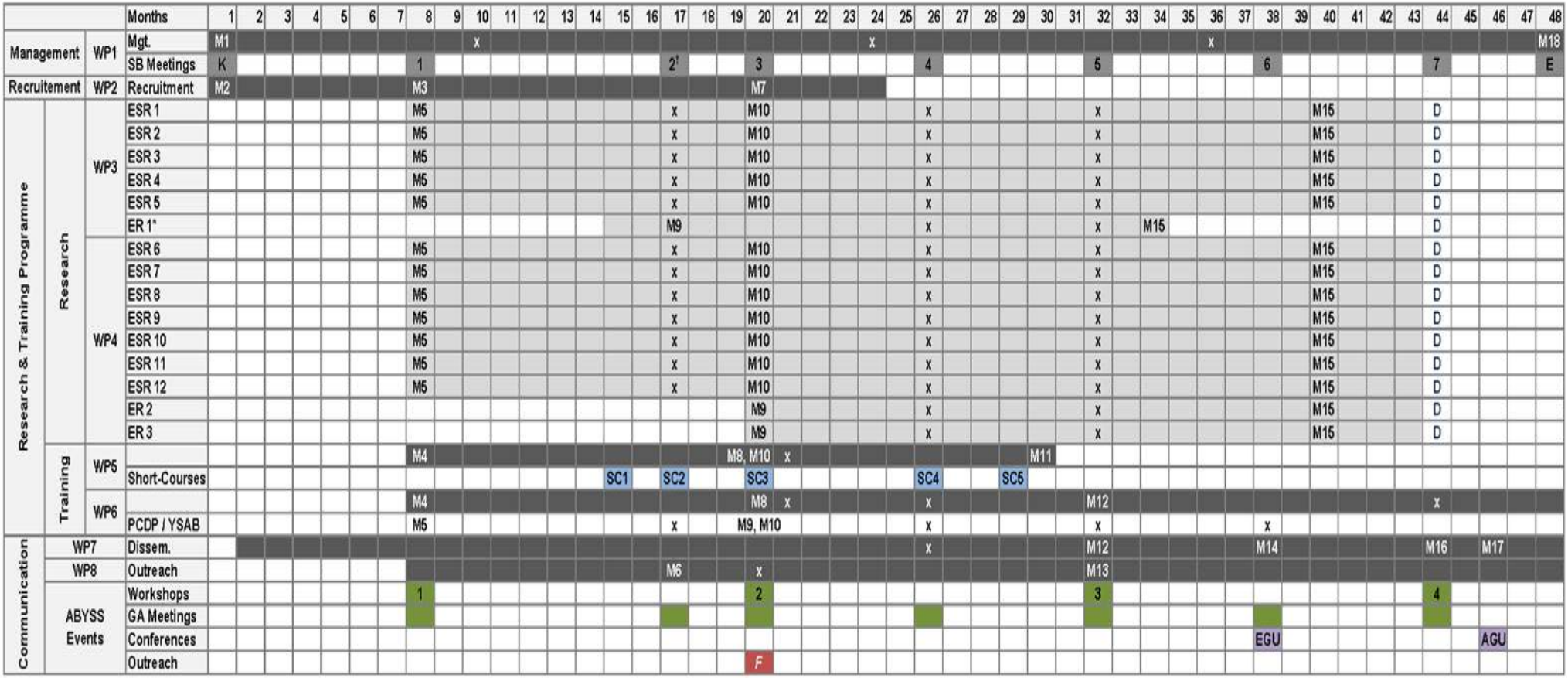
A3.2:
Overall Maximum European Union Contribution

Project Number [1]	608001	Project Acronym [2]	ABYSS

One Form per Project

	Living allowance (1)	Mobility allowance (2)	Contribution to training expenses of eligible researchers and research/transfer of knowledge programme expenses(3)	Management activities (including audit certification) (4)	Contribution to overheads (5)	Total
Year 1	215,665.83	57,889.25	108,000.00	113,299.95	49,485.51	544,340.54
Year 2	647,199.88	161,531.45	295,200.00	97,913.06	120,184.44	1,322,028.83
Year 3	732,683.00	176,436.20	320,400.00	98,702.17	132,822.14	1,461,043.51
Year 4	387,415.29	95,949.70	176,400.00	107,191.34	76,695.63	843,651.96
Total	1,982,964.00	491,806.60	900,000.00	417,106.52	379,187.72	4,171,064.84

Appendix 1: Gantt chart



* ER1 : Milestones shifted to fit both the ERs time-lines and the common ABYSS meeting program †SB Meeting shifted to fit SC meeting program

K - Kick-off; E - End; M - Milestones; SC - Short-Courses; F- Fete de la Science - Paris; EGU - European Geosciences Union Annual Meeting; AGU - American Geophysical Union Fall Meeting; x - Progress meetings and/or Reports; Mgt. - Managemen

D - Main deliverable for ESR & ER project : Revised Individual Scientific Reports (D3.2 & D4.2)

Appendix 2: Extract from the 2013 PEOPLE Work Programme

Structure of the cost categories applicable for ITN (adapted from Table 3.1 and 3.3 of the WP)

This information does not substitute the relevant information of the 2013 People Work Programme, which should be consulted for further details.

1 **Monthly living allowance**	2 **Monthly mobility allowance**	3 **Contribution to the training expenses of eligible researchers and research/transfer of knowledge programme expenses**	4 **Management activities (including audit certification if applicable)**	5 **Contribution to overheads**
Flat rate of : 38 000 Euro/year for ESRs and 58 500 Euro/year for ERs Rate for individual countries is obtained by applying the correction coefficients listed in Table 3.2 of the WP.	Flat rate allowance to cover expenses linked to the personal household, relocation and travel expenses of the researcher and her/his family in the host country: reference rate of EUR 700 for researchers without a family and EUR 1000 for researchers with a family. Rate for individual countries is obtained by applying the correction coefficients listed in Table 3.2 of the WP.	<u>For multi-partner ITNs and IAPP:</u> Flat rate of EUR 1800 per researcher-month managed by the host organisations to contribute for expenses related to the participation of researchers to training activities; expenses related to research costs; execution of the training/partnership project and contribution to the expenses related to the co-ordination between participants. <u>For EID and IPD:</u> Flat rate of EUR 1200 per researcher-month managed by the host organisation(s) to contribute for expenses related to the participation of eligible researchers to training activities and expenses related to research costs, as well as to contribute to the expenses related to the co-ordination between participants.	Maximum of 10% of the total EU contribution.	10% of direct costs except for subcontractors and the costs of the resources made available by third parties which are not used in the premises of the beneficiary.

EU27 and Associated Countries correction coefficients (adapted from Table 3.2 of the WP)

For other countries (such as ICPC and third countries), please consult the WP.

Austria	106.2
Belgium	100.0
Bulgaria	62.7
Cyprus	83.7
Czech Republic	84.2
Denmark	134.1
Estonia	75.6
Finland	119.4

France	116.1
Germany	94.8
Greece	94.8
Hungary	79.2
Ireland	109.1
Italy	106.6
Latvia	74.3
Lithuania	72.5

Luxembourg	100
Malta	82.2
Netherlands	104.1
Poland	77.1
Portugal	85.0
Romania	69.5
Slovak Rep.	80.0
Slovenia	89.6

Spain	97.7
Sweden	118.6
UK	134.4

Albania	63.1
Bosnia & Herz.	74.4
Croatia	83.0
FYROM	60.6
Iceland	95.0
Israel	96.4
Liechtenstein	109.9
Moldova	64.3

Montenegro	65.0
Norway	140.6
Serbia	74.0
Switzerland	119.6
The Faroes	134.1
Turkey	98.4