



Proposal year:  
**2017**

## Project Proposal Form 2017

### **1. INDICATE THE TOPIC(S) INTO WHICH THE PROJECT FALLS**

*For the Annually defined topics -if any- refer to the annual 'Call for IGCP Project Proposals'.*

(i) *Topics of particular interest to IGCP*

- |                     |                                     |
|---------------------|-------------------------------------|
| 1.1 Earth Resources | <input type="checkbox"/>            |
| 1.2 Global Change   | <input type="checkbox"/>            |
| 1.3 Geohazards      | <input checked="" type="checkbox"/> |
| 1.4 Hydrogeology    | <input type="checkbox"/>            |
| 1.5 Geodynamic      | <input checked="" type="checkbox"/> |

(ii) *Annually defined topics*

(iii) *Other relevant topics in basic/applied geoscience*

If this is a Young Scientist Project proposal please tick here

### **2. SHORT TITLE OF THE PROJECT**

*The short title of the project should be as brief as possible but still identify its main objective.*

World Map of the Orogens

### **3. FULL TITLE OF THE PROJECT**

*The full title should be limited to a maximum of around **fifteen words**.*

World Map of the Orogens; Construction and Reactivation of the subsequent Proterozoic, Caledonian, Variscan, and Alpine Mountain Ranges (scale 1:25M)

### **4. DESCRIPTION OF THE PROJECT IN LAYMAN'S TERMS**

*Provide a maximum **200 words-long**, self-contained summary of the project, including its societal benefits. It should be written in plain English / layman's terms and for the non-specialist using a minimum of terminology unique to the area of study. This text will be used to describe your project on the UNESCO website.*

The formation of the continents results of the super-imposition of several orogeny that are difficult to apprehend for geoscientists, not mentioning the non-specialists. More specifically, the location on formal crustal boundaries is crucial for understanding processes leading to ocean formation and those ones reactivating of previous tectonic structures to build mountain ranges. During these processes having a direct effect on atmospheric and water circulation, basins are formed with their oil potential, and then inverted with subduction yielding volcanic arc and ore deposits.

The project covers the whole plate tectonics history of the Earth with increasing details toward Present times. We will design a map encompassing all the successive orogens, with a focussed legend on the key element of a "Generic Mountain Range".

The map will be digital allowing to display mountain ranges over the times independently. It will be built as a useful and simple tool to visualize the evolution of continents and its implications on the distribution of earth resources, seismic hazard, and global change. It will have a strong educational outcome and be designed as a ludic tool useful for students and teachers. It will be light and easy to use even in remote places of the World.

## **5. PROPOSED BY**

*Academic titles and names of the proposer(s) should be inserted. Provide also full mailing address(es), telephone, fax numbers, and e-mail address(es). The first listed name will be the focal point for future correspondence. UNESCO and IUGS encourage you to respect gender equality issues and inclusion of experts from developing countries in all new IGCP projects.*

### **Manuel PUBELLIER**

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### **Miss Siti Nur Fahiyah JAMALUDIN**

MSc Petroleum Geoscience

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### **Mrs. Andreina GARCIA-REYES**

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## Professor Christian Robert

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## The Commission for the Geological Map of the World

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+33 147072284  
e-mail : [ccgm@sfr.fr](mailto:ccgm@sfr.fr)  
Web site : [www.ccgmm.org](http://www.ccgmm.org)

### **6. SCALE OF THE PROJECT**

*The scale of the project must be indicated among the choice given.*

- sub-continental/regional
- continental
- inter-continental

### **7. ESTIMATED DURATION OF THE PROJECT**

*Maximum life-time of an IGCP project can be five years.*

- 3 years
- 4 years
- 5 years

### **8. FULL DESCRIPTION OF THE PROJECT (SECTIONS 8.1 THROUGH 8.10)**

#### **8.1 Aims and background**

*Describe the aims and rationale of the proposal. Include information on work already undertaken by the proposers that is relevant to the proposal. **Maximum length: 600 words**, including bibliography.*

Orogenic belts in the world are one of the best expression and signature of the earth history created by plate motion whose marks are relief deformation, formation of geologic structures (mountains, rifts, valleys, basins...), but by also of mineral resources and geohazards. The aim of the project is to build a map and a database of the main orogenic belts that should permit a step by step lecture reflecting the continental configuration all along the history of the earth. If it is possible to characterize with well-documented examples the successive stages in development and evolution of continents, the process of construction and collapse by gravity or erosion of the mountain belts is difficult to depict because one orogen partially erases the previous one. Examples of maps, already completed and published at CGMW such as Structural map of Eastern Eurasia (Pubellier, 2008), Tectonic framework of the Alps (Bousquet et al., 2012), Structural map of the Arabian Plate (Frizon de Lamotte et al., 2013) attempted to tackle part of this difficulty. However a comprehensive tool is lacking to apprehend this key process of mountain building and reactivations.

Therefore main rationale of the project is to start from the grassroots level of geology by identifying the key elements of an orogen and to place them accurately on a map in order to delineate where they sit relative to the cratons boundaries and the pre-existing and older orogens. The approach is de facto also a way the evolution of the continents can be explained and taught to a non-specialists audience and to the geosciences community. Hence, the map could reveal to be crucial for a global and comprehensive approach of our environment in terms education, natural resources and geohazards.

The workflow is to proceed in parallel for 1) the identification of the major components of an orogen, which may vary as we go backward through time, and to examine how to best report them on a map, and 2) the location and geometries of each orogen of the Earth. Experts aware of the geology and the rationale of the map will then assist in populating the map, and supply simple criteria in order to construct a database.

## **8.2 Significance**

*Describe why the project is significant (scientific advancement, international cooperation, knowledge transfer, technological advancement, etc.) and why support through IGCP funding is crucial to its success. **Maximum length: 400 words.***

The main rationale of the project is to constitute a base map and support for several international cartographic projects such as;

The next Seismotectonic Map of the World (Coordinated by M. Megrahoui, in discussion)  
The world Map of Dykes Swarms and LIP (coordinated by R. Ernst, almost completed)  
The Metamorphic map of the world (in project)

The scientific advance resides in the clear vision of the way mountain range superimpose through time. At places between old shields or cratons, suture have developed since the Proterozoic (e.g. Grenvillian/Caledonian/Variscan of the Europe and N. America), appear to have been solicited again and again by extensional forces (bulk forces) which re-open ocean floor within their core or rather on their sides, signing the location of a future orogen parallel to the existing one. In other cases the subsequent orogen intersects the previous one probably due to changes in the boundary conditions.

The international collaboration is already established on all the continents and already functioning. The technical advance will be in ensuring that the deliverable is a product that, besides being a comprehensive paper map, will be a digital tool which will allow teaching at all levels in the developing world, including via a cellular phone or a station with a low Internet connection.

IGCP funding appear to be ideal to support the organisation of international workshops, necessary discuss the advance of the map and allow experts of selected regions to confront ideas.

## **8.3. Present state of activities in the field of the proposed project**

*Describe the present state of activities in the field of the proposed project. Include the names of relevant institutions and persons in charge. This should be precisely stated since it reflects the proposer's awareness of the general state of the proposed research field. **Maximum length: 1,000 words.***

The PIs are involved in the Commission for the Geologic Map of the World; either in the Steering Committee, or into map projects. The CGMW is responsible for coordinating international map projects for the over 100 years, and has a large portfolio of maps production. In this project, we will involve 8 Continental and 3 Thematic Sub-Commissions, spearheaded by their Vice Presidents and Secretary Generals, including women and scientists from Geological Surveys and academic institutions already integrated into CGMW international projects.

The project is an appendix of the Geological Map of the World, for which we have recently (Sept. 2017) elaborated an accurate database. A preliminary Kick off working Group had been designated and had one meeting at CGMW HQ in May 2017.

The philosophy and the outcomes of the projects have been discussed with the Kick off group. Actions have been taken at 3 levels:

- 1) Establish a Generic Mountain Range whose characteristics can be applied to a majority of orogens in the world,
- 2) Define a Legend in a way that can depict the structures and their varying complexities through time
- 3) Sketch a general preliminary map and several enlargements to test the feasibility and the readability of the map.

These activities have started and the result will be presented at the CGMW General Assembly which will take place at UNESCO in February 2018. During this meeting a call for participation into geographic sub-groups, most likely corresponding to the CGMW continental sub-commissions will be launched.

#### **8.4 Workplan (items by year)**

*The work schedule should be prepared bearing in mind that, as a rule, projects will be accepted for a duration of five years maximum. The work schedule should include field and laboratory work, meetings, capacity building activities or short courses, field trips, conferences, etc. **Maximum length: 1,200 words.***

The project is scheduled for 3 years only.

1<sup>st</sup> year will be dedicated to set a Generic Mountain Range whose characteristics can be applied to a majority of orogens in the world, and design legend. The first year will be also time for sketching a general preliminary map and several enlargements to test the feasibility.

2<sup>nd</sup> Year. The second year will be dedicated to the map compilation. We require the leaders of each regional group to work on a clear synthesis of the successive orogens of their respective areas, following a unique pre-defined legend.

3<sup>rd</sup> Year. The third year we will correlate all the different pieces of the map and; Elaborate a simple database.

A digital map which will allow the different orogens to be displayed independently and together, with or without the successor basins.

Print the paper map.

Advertise for the product in order to maximize the diffusion.

There is no laboratory analyses required, and no field work. There will be conferences and even synthetic academic papers. We plan to organise online short courses and/or web courses to explain the way the map was constructed and how it can be used.

## 8.5 Results expected

*Results expected should be specified as precisely as possible in respect of theoretical and applied science (including general applications where these are foreseen), as well as anticipated societal benefits. Outcomes should include both those expected at the end of the project as well as those to be achieved at the end of each year for which funding is requested. Meetings and conferences are not considered as results. **Maximum length: 1,200 words.***

- a) in basic sciences**
- b) in applied sciences and technology**
- c) in respect of benefit to society**

In basic sciences. Structure and evolution of fold belts. Synthesis of current state of knowledge essentially suture zones, orogens including on early Proterozoic supercontinent. Location of potential reactivation of tectonic structures

In applied science. Distribution of earth resources with reference to belts. Types of ore deposits which are particularly dependant on reactivation of structures and associated fluid circulations. Hydrocarbon deposits for which traps are associated to tectonic inversions during the shift from an orogen to the other.

In respect to benefit to society. The Map will be a support for the next geosciences maps including the seismotectonic map of the World with direct impact on geohazards which will benefit education, public awareness and decision makers.

## 8.6 Participation

*Provide a list of contributors to the project and the areas to which they will contribute. Applicants should note that an important aim of this program is to encourage involvement of scientists from the developing countries.*

- a) countries or institutions (or individuals) which have already agreed to co-operate**

10 members of the Kick off meeting

8 continental sub-commissions of the CGMW :

**Dr. Kristine Asch, CGMW Vice-President for Europe**

Bundesanstalt für Geowissenschaften und Rohstoffe (BGR)

**Dr. Carlos Schobbenhaus, CGMW Vice-President for South America**

CPRM – Brasilia, Brasil

**Dr. Marc. R. St-Onge, CGMW Vice President for North & Central America**

Geological Survey of Canada, Ottawa, Canada

**Dr. Félix Toteu, CGMW Vice-President for Africa**

Cameroon

**Prof. Jishun REN, CGMW Vice-President for South & East Asia**

Institute of Geology of the Chinese Academy of Sciences, Beijing, China

**Dr. Abdollah Saidi, CGMW Vice-President for the Middle East**

National Geoscience Database of Iran, Tehran, Iran

**Dr. Oleg Petrov, CGMW Vice-President for Northern Eurasia**

A.P. Karpinsky Geological Research Institute (VSEGEI), St Petersburg, Russia

**Dr. German Leychenkov, CGMW Vice-President for Antarctica**

VNIIOkeangeologia, Antarctic Geology Dept., St Petersburg, Russia

1 thematic Sub-commission of the CGMW

**Dr. Igor Pospelov, Secretary General of CGMW S/C for Tectonic Maps**

Geological Institute of the Russian Academy of Sciences, Moscow, Russia

**b) countries likely to participate**

Potentially all the countries via their Geological Surveys. Announcement will be made at the next General Assembly of CGMW at UNESCO in February 2018.

**c) Which specific measures will the applicants of the proposal take to actively involve scientists from developing countries, young scientists and female scientists at all levels?**

*Provide approximate participation estimations of the groups mentioned above if possible and be aware that IGCP expects exact numbers of participation of the different groups in each Annual Report.*

The applicants are used to work and organise international meetings involving developing countries. Since the project covers the entire world, researchers of countries where mountain ranges exist or have existed will be contacted according to their expertise. Therefore developing countries and particularly young scientists will be selected preferably for workshops. We will also encourage them to submit papers related to the project and provide guidance from the senior geologists, We will encourage a gender balance for all the workshops which will be organised; and schedules of presentations will take into account specific personal time constraints

As it is the custom at CGMW, the final draft of the Map is send to all the participants for cross-checking of the information displayed.

**d) Will there be collaboration with or activities involving other IGCP projects, UNESCO programmes, IUGS Commissions and Task Groups or others?**

- CGMW Commissions are de facto part of the project and will be met at CGMW GA in February 2017
- IGCP Project-589 (*Development of the Asian Tethyan Realm*) is an ongoing project which is relevant to our topic, for the Phanerozoic

**8.7 Location of major field activities**

N/A

**8.8 Location of major laboratory research (assured co-operation of laboratories)**

*State names and locations of laboratories that have agreed to conduct laboratory work.* Steering committee Meetings will be held at CGMW in Paris or/and during existing International meetings (AGU, EGU, IGC, and GA of CGMW). Skype meetings will be set for “business as usual” issues.

**8.9 Project Communication:**

*Identify plans for future scientific publications (e.g. peer-reviewed journals), informal publications (e.g. abstracts, guidebooks, textbooks) and others (e.g. internet access to data bases, TV programs, exhibits, public briefings for decision makers).*

The scientific issues which are related to tectonic reactivations are very much debated nowadays within the community of geosciences. Since our map concerns the whole world, we expect and we are confident that it will trigger discussions. We plan to deliver:

- Reports of activities, and methodology to be posted on the CGMW Website
- 1 scientific article to present the map in “Episodes”
- 1 scientific paper discussing the evolution of the mountain ranges through Proterozoic and Phanerozoic times
- 3 regional papers on reactivation processes
- Several abstracts at international meetings, (including during the project)

- The map will be draped on a 3D globe using the existing VisioTerra viewer (visioterra.org/VtWeb) like many CGMW maps for friendly and free of charge use anywhere an internet connection is available. The map will be also available on Google Earth via CGMW.

#### **8.10 Project Website:**

*Provide a clear plan for the project website including ongoing maintenance of the site. Give the weblink if the website is already up and running.*

We consider two options:

One is to create a website dedicated to the project and which will be managed at CGMW.

The second option is to create a page attached to the existing CGMW website. This possibility would add visibility to the project.

**8.11 Scientific Legacy: Is there a need for storage of publications, field data, and other results of the project? Do you have a clear vision concerning where the data would be stored and who will be the custodian?**

N/A

#### **8.12 Budget**

*Outline how the IGCP funds will be spent over the proposed duration of the project. Be sure to specify specific IGCP expenditures (see allowable items in "Guidelines" section 7). List other potential (external) sources of funds and how IGCP funds may help in leveraging funds from other organizations. Provide a realistic estimate of the total cost (including non-IGCP sources) of the project, itemizing expenditures such as fieldwork expenses, laboratory costs, meetings, etc. (even though such costs may not be charged to IGCP).*

##### **Total Cost of the Project**

- Travel expenses of scientists for one meeting /year over 3 years including hotel and food expenses.	
- paid by their affiliated bodies:	20.000 EUR
- paid by CGMW (back to back with GA)	10.000 EUR
- Kick off Meeting at CGMW (Jan 2017, paid by CGMW)	4.000 EUR
- Cost of computer, plotter printing	10.500 EUR
- Prepress data processing transfer to online 3D (paid by Total) digital support (1 month temporary contract)	10.000 EUR
- Supplies, telecommunications, mail and running cost	1.000 EUR
- Percentage (10%) of the Project Leader's salaries	72.000 EUR
	<hr/>
Total	127. 500 EUR

##### **Breakdown of expenditures foreseen under IGCP Contribution**

Part of travel expenses of scientists / 3 per year average	15.300 EUR
Meeting organisation expenses	4.500 EUR
Map tests and final printing	10.000 EUR
	<hr/>
Total requested	29.800 EUR



## 8.13 Curriculum Vitae of proposer(s)

*CVs of proposed leader(s) should be limited to three pages and include key publications (international peer-reviewed publications only), relevant scientific experience, any previous involvement in IGCP and/or other international research cooperation programs, including the organization of international meetings.*

### CV 1 - Manuel PUBELLIER

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Citizenship : French

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#### Education

1999 HDR in Geosciences (U. P&M Curie)  
1984 PhD in Geosciences  
1982 Master (Geology)

#### Professional appointments

2015-2017 Director of Research at CNRS / ENS; Head of Geology/Geophysics/Geodesy team  
2011-2013 Dean of the University Technology of Petronas, Perak, Malaysia, and MA6 “Star” Professor  
2011-2014 Researcher CNRS at Ecole Normale Supérieure (ENS) and Research Director Since 2013  
2006 Researcher (secondment) at TOTAL E&P Paris  
1995-2012 Researcher CNRS at Ecole Normale Supérieure (ENS)  
1988-1995 Researcher at Univ. P&M Curie  
1984-1986 Lecturer in Geology (EMTG, Port au Prince, Haïti).

#### Research Interests

Geodynamics and Structural Geology of margins onshore and offshore, Imagery, seismic interpretation,

#### Services over the last 10 years :

Member of SGF- Geological Society of France, Assistant Editor 1988-1991, Vice President 1991-92  
Occasional or regular member of AGU, EGU, AAPG, SEP, EAGE  
2007-2011 Editor of the IGMA5000 (International Geological Map of Asia at scale 1/5M) for CGMW and UNESCO  
2007-20011 Coordinator and Secretary General of CGMW, Member of DIMAS (Int Gp for geological Map standards)  
Member of the Steering Committee of OneGeology International Project  
Consultant for Oil and Mining industry project with Geolines

#### Responsibilities in education and national/international projects over the last 10 years :

##### *PhD-Msc supervision*

Supervisor of 26 PhD thesis, and 16 MSc

##### *Lectures*

20013-20&- Lectures at ENS and P11  
2006-2009 Universiti Teknologi Petronas Malaysia, Geodynamics, Regional and Petroleum basins of SEAsia, Structural geology, Introduction to Petroleum Geosciences, Mapping and Remote sensing for FYP  
1994-2009, IFP school, France, Geology, tectonics, Geodynamics, Sedimentology, Stratigraphy  
2005-2008 Invited Professor Graduate School of Chinese Acad of Sciences, China, Geodynamics and Geology of China and Asia,  
2005-2010, University of Hong Kong, DES; Field Training, Lectures in remote sensing  
1997-2011-ENS- Ecole Normale Supérieure: Tectonics, Geodynamics, Remote sensing, Field training in France, Italy, USA,  
1990-1997University of Paris 6, Masters Level, Geodynamics, Remote sensing, Geo-environments  
1984-1986 Ecole Moyenne de Techniciens Géologues; Haïti; Lectures in Geology, and field courses

#### Main projects

##### *Offshore*

1987-1988; Participation to ODP Leg 124 in Southeast Asia on Joides-Resolution  
1993; Participation to Surveys international survey Indonesia on Baruna Jaya; Project MENTAWAI 2  
1995; Participation and organiser of IFREMER survey MODEC  
2011; South China Sea CGS-GMGS-ENS-CNRS, Chief Scientist: Seismic Refraction (OBS) and MCS geophysical cruise  
First cooperative Geophysical Cruise between Chinese Government and International scientists.  
2002–2005; Project manager of the Offshore Tectonic synthesis (CONOCO, EXXON, UNOCAL, TOTAL-FINA-ELF)

##### *Onshore over the past 10 years*

2015; Co PI on proposal ICDP/IODP drilling in Haïti (Caribbean), and co-supervisor on Structural Map of the Caribbean (CGMW)

2015; Co PI on Project Dynamic Topography Indonesia-Malaysia-Thailand (U Grenoble, Nantes, UBS, UTP)

2015; Co-Project Manager on Coral Sea Project (Seismics)

2014; Project Manager of Total-ENS project on the Andaman Sea (Seismics and field work)

2012-2014; Project (YUTP) on Sabah basement (PI) collaboration with UMS, and Malacca Strait (YUPT)

2009-2012; SE Asia CNRS-ENS-BGR-TOTAL Project Manager. GRI (Research/Industry Group). Synthesis of South China Sea margins basement and sedimentary structures. Basins formation and petroleum assessment.

2009-2011; China (Sichuan) Project Manager, ENS-CDUT-SW Petroleum Institute, Management of Longmen Shan Project. Geophysical (Seismic Receiver functions), Tectonic and Petrology of the Longmen Shan Range; reactivation of a former passive margin Cooperation with Chengdu University (Inst of Geophysics), SW Petroleum Institute, and ENS

2007-2010; Brunei-Malaysia, TOTAL/CNRS Project Manager and PhD supervision; Study of the NW Borneo Wedge in terms of sedimentary evolution during tectonic deformation. Timing of wedge formation and counter-regional faults. Evaluation of gravity tectonics and deltas deposition. Impact of subduction of Luconia Platform subduction beneath the wedge

2006-2007; SE Asia. TOTAL HQ Compilation of the structures of the Oil-bearing basins of SE Asia

2005-2008; Indonesia CNRS-TOTAL. Structural Study onshore/offshore of the foreland of the Lengguru Range (West Papua) Helicopter and boat supported Field and desk study of seismic lines and wells.

### Organisation of international meetings

Organiser of International Workshops (GEOSEA, ESTCON-ICIPEG2014),  
 convener of sessions at International congresses (AGU, EGU, IGC34, IGC35, AAPG). Many keynote speeches at international conferences. Regular reviewer of international papers (~2/months)

6 Special sessions at EGU and AGU meetings

Int. Workshop on the South China Sea (Paris 2011)

Int Workshop on the Tectonic Map of the Arctic- TeMar project 2014 and 2017 (Paris)

CGMW special sessions at IGC 2012 and 2016

Co-organisation of CGMW International Gen. Assembly (2012, 2014, 2016)

### Publications

376 publications in peer review international journals and international abstracts:

International reviewed papers	= 137
Abstracts in International Meetings	= 225
Geological Maps and Atlases	= 14

### Publications since 2010 (in peer reviewed international journals only)

- 2010 Robert, A., M. Pubellier, J. de Sigoyer, J. Vergne, A. Lahfid, R. Cattin, N. Findling, and J. Zhu (2010), Structural and thermal characters of the Longmen Shan (Sichuan, China), *Tectonophysics*, v. 491(1-4), pp. 165-173, doi : 10.1016/j.tecto.2010.03.018, [abstract](#)
- 2010 Robert, A., J. Zhu, J. Vergne, R. Cattin, L. S. Chan, G. Wittlinger, G. Herquel, J. de Sigoyer, M. Pubellier, and L. D. Zhu (2010), Crustal structures in the area of the 2008 Sichuan earthquake from seismologic and gravimetric data, *Tectonophysics*, v. 491(1-4), pp. 205-210, doi : 10.1016/j.tecto.2009.11.010, , [abstract](#)
- 2010, Chan, L. S., W. L. Shen, and M. Pubellier (2010), Polyphase rifting of greater Pearl River Delta region (South China) : Evidence for possible rapid changes in regional stress configuration, *J. Struct. Geol.*, v. 32(6), pp. 746-754, doi : 10.1016/j.jsg.2010.04.015, [abstract](#)
- 2010, de Michele, M., Raucoles, D., de Sigoyer, J., Pubellier, M., Chamoot-Rooke, N., 1010. Three-dimensional surface displacement of the 12 May 2008 Sichuan earthquake (China) derived from Synthetic Aperture Radar: evidence for rupture on a blind thrust, *Geophys. Journ. Int.*, *Doi : 10.1111/j.1365-246X.2010.x*
- 2011, Sapin, F., Pubellier, M., Lahfid, A., Janots, D., Aubourg, C., Ringenbach, J.C., 2011, Onshore record of the subduction of a crustal salient: example of the NW Borneo Wedge., *Terra Nova*, 00, 1-9, 2011, Blackwell Publishing Ltd, doi: 10.1111/j.1365-3121.2011.01004.x
- 2011, de Sigoyer, J., A Billerot, A Robert, S Duchêne, O Vanderhaeghe, M Pubellier, 2011. How the paradoxical Longmen Shan belt has been built: through new petrological structural geochronological data? *Journal of Himalayan Earth Sciences* 44 (1), 9
- 2011, Robert, A., M Pubellier, J de Sigoyer, A Lahfid, P Lanari, J Vergne, O Vidal., 2011. Crustal-scale deformation history of the Longmen Shan polyphased range located at the eastern border of the Tibetan plateau. *Journal of Himalayan Earth Sciences* 44 (1), 68
- 2012 Sapin, F., Pubellier, M., Lahfid, A., Janots, D., Aubourg, C., Ringenbach, 2012. "Counter-Regional Normal Faults in shale-dominated deltas: Origin, Mechanism and Evolution". *Marine and Petroleum Geology*, Volume 37, Issue 1, Pages 121-128
- 2013 Pubellier, M., Meresse, F., 2013, Phanerozoic Growth of Asia; Geodynamic Processes and Evolution. *Journal of Asian Earth Sciences*, 72, pp. 118-128, DOI-10.1016/j.jseas.2012.06.01
- 2013, Sapin, F., Ringenbach, J.C., Rives, T, Pubellier, M., 2012. Counter-Regional Normal Faults in shale-dominated deltas: Origin, Mechanism and Evolution. *Marine and Petroleum Geology*, Ms. Ref. No.: JMPG-D-11-00231R1 in press
- 2013, Sapin F., Hermawan, I., Pubellier, M., Vigny, C. Ringenbach, J.C., 2013 The Recent Convergence on the NW Borneo Wedge – A Crustal-scale Gravity Gliding evidenced from GPS. *Geophysical Journal International*, 193 (2): 549-556. doi: 10.1093/gji/ggt054, <http://gji.oxfordjournals.org/content/193/2/549.short>
- 2013, Steuer, S., Franke, D., Meresse, F., Savva, D., Pubellier, M., Auxietre, J.L., Aurelio, M, 2013. Time constraints on the evolution of southern Palawan Island, Philippines from onshore and offshore correlation of Miocene limestones, *Journal of Asian Earth Sciences*, 2013, Volume 76, 25 October 2013, Pages 412-427
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- 2016, Sautter B., Pubellier, M., Jousset, P., Dattilo, P., Kerdraon, Y., Choong, C.M., Menier, D., 2016. Late Paleogene rifting along the Malay Peninsula thickened crust. Tectonophysics, Volumes 710–711, 25 July 2017, Pages 205-224. DOI: 10.1016/j.tecto.2016.11.035
- 2017, Menier D., Mathew M., Pubellier M., Sapin F., Delcaillau, B., Siddiqui M., Ramkumar M., Santosh M., 2017. Landscape response to progressive tectonic and climatic forcing in NW Borneo: Implications for geological and geomorphic controls on flood hazard, Nature Scientific Reports, accepted
- 2017, Jamaludin, F., M. Pubellier, M. & Menier, D. Structural Restoration of Carbonate Platform in the southern part of Central Luconia, Malaysia. 2017, Sci. Reviews, in press
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## Geological Maps and Atlases

- 2005 Pubellier, M., Rangin, Ego et al. 2005, Atlas of the margins of SE Asia. Mémoires de la Société géologique de France, 2005, vol. 176 (32 p.) Geol. Soc. France / Amer. Assoc. Petrol. Geologists, N°176, 6 maps, 4 chap., 1CDRom. ISBN 2-85363-090-0, ISSN 0249-7549
- 2008 Pubellier, M., Chan, L.S., et al., 2007, Morpho-tectonic Map of Cenozoic structures of the South China / Northern Vietnam coastal region. Map with explanatory notes and CDRom, Output-express Print Off. Hong Kong, ISBN 978-988-98896-4-7, 16p.
- 2008 Pubellier, M., N. Chamot-Rooke, F. Ego, J.-C. Guezou, E. Konstantinoskaya, A. Rabaute, J. Ali, Jonathan C. Aitchison, C. Aubourg, J. Charvet, M. Fournier, R. Hébert, L. Jolivet, C. Lepvrier, G. Masclé, I. Popolov, J.-C. Ringenbach, S. Shokalsky, M. Sosson, J. Verges, C. Wang. 2008 Structural Map of Eastern Eurasia; Evolution of Structural Blocks and Tectonic Belts through Time, scale 1:12.500.000, 1st edition, 2008, published by CGMW and UNESCO
- 2008 Bouysse P. .... M. Pubellier et al., Geological Map of the World, 3eme édition (2009 et 2010), Echelles:1/50000.000 (118 x 54 cm), 1/25 000 000 (242 x 108,5 cm), published by CGMW and UNESCO, [http://ccgm.free.fr/index\\_fr.html](http://ccgm.free.fr/index_fr.html)
- 2012 Ren Jishun, .... M. Pubellier et al., International Geological Map of Asia, scale:1/50000.000 (118 x 54 cm), 1/25 000 000 (242 x 108,5 cm), published by CGMW and UNESCO, [http://ccgm.free.fr/index\\_fr.html](http://ccgm.free.fr/index_fr.html)
- 2016 Miles, P., Pubellier, M., Collot, J., Ocean Floor of the Western Pacific, 1/35M, CGMW
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## CV 2- Romain BOUSQUET

Professor, CAU Kiel

Birth: 19th February 1969, Lyon, France

Citizenship: French

Civilian status: Married, 4 children

Languages: French (native language), German, English, (Italian)

### EDUCATION:

2008 German habilitation (Lehrbefähigung) in Geodynamics, University of Potsdam, Germany

1998: Ph.D, University Paris XI - ENS Paris, France

### EMPLOYMENT HISTORY

01/13-: Full Professor, University of Kiel, Germany

12/10-12/12: Full Professor for Lithosphere Dynamics, University of Rennes, France

01/05-12/10: Junior Professor, University of Potsdam (Germany)

06/01-12/04: University assistant, University of Basel (Switzerland)

04/19-05/01: Postdoctoral Fellow of the SNF, University of Basel (Switzerland)

10/98–04/99: Potsdoc, Ens, Paris (France)

07/95-10/98: Teaching assistant at the University of Versailles-St Quentin (France)

03/94–06/95: Research assistant at the University of Mainz (Germany)

### SCIENTIFIC SERVICES

02/2014-: Secretary General of the commission for Magmatic and metamorphic Maps (CGMW)

since 2002-: Member of the commission for the metamorphic map of the Alps (CGMW)

2000-2010: member of the Award committee of the French Geological Society (SGF)

2003-2004: Member of the scientific commission of the French Geological Society

### SCIENTIFIC REVIEWS

Grant Committees: INSU (France), FWF (Austria), DFG (Germany)

Journals: G. cubed, Tectonophysics, J. Met. Geol., Eclog. Geol. Helv., Lithos, SMPM, GeologicalMagazine, EJM, Earth Review

### PUBLICATIONS

*Name followed by a star are name of supervised PhD or Master student.*

Clerc, C., Lagabrielle, Y., Labaume, P., Ringenbach, J.-C., Vauchez, A., Nalpas, T., **Bousquet, R.**, Ballard, J.-F., Lahfid, A. & Fourcade, S. 2016. Basement – Cover decoupling and progressive exhumation of metamorphic sediments at hot rifted margin. Insights from the Northeastern Pyrenean analog. *Tectonophysics*, 686, 82–97.

Chelalou, R., Nalpas, T., **Bousquet, R.**, Prevost, M., Lahfid, A., Ringenbach, J.-C., & Ballard, J.-F. 2016. New sedimentological, structural and paleo-thermicity data in the Boucheville Basin (eastern North Pyrenean Zone, France). *C. R. Geoscience*, 348: 312-321

Pourteau, A., **Bousquet, R.**, Vidal, O., Plunder, A., Duesterhoeft, E., Candan, O., & Oberhänsli R., 2014, Multistage growth of Fe–Mg–carpholite and Fe–Mg–chloritoid, from field evidence to thermodynamic modelling, *Contributions to Mineralogy and Petrology*, 168, 1090, doi: 10.1007/s00410-014-1090-7.

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Van Hinsbergen, D. J. J., Buitert, S. J. H., Torsvik, T. H., Gaina, C. & Webb, S. J., *Geological Society, London, Special Publications*, 357, 285-300, doi: 10.1144/SP357.15

Wiederkehr M\*, **Bousquet R.**, Ziemann M., Berger A. & Schmid S. M., 2011, 3-D assessment of peak-metamorphic conditions by Raman spectroscopy of carbonaceous material: an example from the margin of the Lepontine dome (Swiss Central Alps), *International Journal of Earth Sciences*, doi: 10.1007/s00531-010-0622-2

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Handy MR., Schmid S.M., **Bousquet R.**, Kissling E. & Bernoulli D., 2010, Reconciling plate tectonic reconstructions of Alpine Tethys with the geological-geophysical record of spreading and subduction in the Alps, *Earth Sciences Review*, 102, 121-158

Wichura H\*, **Bousquet R.**, Oberhänsli R., Strecker MR. & Trauth M., 2010, Evidence for Mid-Miocene uplift of the East African Plateau, *Geology*, 38, 6: 543–546

Wiederkehr M\*, Sudo M., **Bousquet R.**, Berger A. & Schmid S., 2009, Alpine orogenic evolution from subduction to collisional thermal overprint: The Ar-40/Ar-39 age constraints from the Valaisan Ocean, central Alps, *Tectonics*, 28, TC6009

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**Bousquet R.**, El Mamoun, R., Saddiqi, O. & Goffé, B., 2008 Mélanges and ophiolites: was the Bou-Azzer's ophiolite suite (Morocco) a Franciscan-type wedge during the Pan-African orogeny?, in *"The Boundaries of the West African Craton"* Eds Ennih, N. & Liégeois, J.-P., Geological Society, London, Special Publications, 297: 233-247.

**Bousquet R.**, 2008, Metamorphic heterogeneities within a same HP unit: overprint effect or metamorphic mix?, *Lithos*, 103, 46-69.

Bucher S\*, & **Bousquet R.**, 2007 Metamorphic evolution of the Briançonnais units along the ECORS-CROP profile (Western Alps): New data on metasedimentary rocks, *Swiss Journal of Geosciences*, 100(2), 227-242

**Bousquet R.**, Goffé, B., de Capitani, C., Chopin, C., Le Pichon, X. & Henry, P., 2005, Comment on "Subduction factory 1. Theoretical mineralogy, densities, seismic wave speeds and H<sub>2</sub>O contents" by Bradley R. Hacker, Geoffrey A. Abers and Simon M. Peacock, *Journal of Geophysical Research*, 110, B02206

**Bousquet R.**, Goffé B., Vidal O., Patriat M., & Oberhänsli R., 2002. The tectono-metamorphic history of the Valaisan domain from the Western to the Central Alps: New constraints for the evolution of the Alps. *GSA Bulletin*, 114, 207-225

**Bousquet R.**, Oberhänsli R., Goffé B., Jolivet L. & Vidal, O., 1998. High pressure-low temperature, metamorphism and deformation in the „Bündnerschiefer“ of the Engadine window: Implications for the regional evolution of the eastern Central Alps. *Journal of Metamorphic Geology*, 16, 653-674

**Bousquet R.**, Goffé B., Henry P., Le Pichon X. & Chopin C., 1997. Kinematic, thermal and petrological model of the Central Alps: Lepontine metamorphism in the upper crust and eclogitisation of the lower crust. In: *Collision Orogens: Zones of Active Transfers between Crust and Mantle* (eds. Touret, J. R. L. & Austrheim, H.) *Tectonophysics*, 273, n°1-2, 105-127

#### **Books**

Robert C. & **Bousquet R.**, 2013, Géosciences, la dynamique du système Terre (Textbook in french) *Belin*, Paris.

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#### **Maps**

**Bousquet R.**, Roland Oberhänsli, Stefan M. Schmid, Gerold Zeilinger, Christian Robert, Andreas Möller, Alfons Berger, Michael Wiederkehr, Claudio Rosenberg & Friedrich Koller, 2012, Metamorphic framework of the Alps (1:1'000'000) 2d Edition, *CCGM/CGMW*, Paris,

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Oberhänsli R., **Bousquet R.**, Engi, M., Goffé, B., Gosso, G., Handy, M., Höck, V., Koller, F., Lardeaux, J.-M., Polino, R., Rossi, P., Schuster, R., Schwarz, S., Spalla, M. I., 2004, Metamorphic structure of the Alps (1:1'000'000), *CCGM/CGMW*, Paris

#### **Excursion Guides**

**Bousquet R.**, Bertlé, R., Goffé, B., Höck, V., Koller, F. & Oberhänsli, R., 2004, The Engadine Window at the border of the eastern and central Alps. In: *Thermo-mechanical evolution of the Alpine Belt, from Engadine Window to the Matterhorn* (eds. Gosso, G., Engi, M., Koller, F., Lardeaux, J.-M., Oberhänsli, R. & Spalla, M. I.) *Field Trip Guide Book, 32nd International Geological Congress*, B29, 17-18

## **CV-3 – Siti Nur Fathyyah JAMALUDIN**

Citizenship : Malaysian

### **Academic qualification**

#### **MSC Petroleum Geoscience**

Universiti Teknologi Petronas (UTP), Malaysia  
March 2012-August 2014

Conduct excellence research in seismic interpretation, carbonate seismology and structural restoration with thesis title of “The Role of Faulting on the Growth of Miocene Carbonate Platforms in Central Luconia Province, Sarawak, Malaysia”.

#### **BSC Applied Geology**

Curtin University of Technology, Perth, Western Australia.  
Feb. 2006-Feb. 2009

Through the degree, had received two awards from Petroleum Exploration Society of Australia (PESA) Award for 2<sup>nd</sup> year and 3<sup>rd</sup> year Outstanding Performance in Petroleum Related Subjects.

### **Publications**

- Jamaludin, SN Fathiyah., Pubellier, Manuel, and Menier, David. “Structural Restoration of Carbonate Platform in the Southern Part of Central Luconia, Malaysia”, Journal of Earth Science. (Accepted for Publication-expected publication date November 2017).
- Azman, Nurul Izzati.,and Jamaludin, SN Fathiyah., “Relationship of oil seep in Kudat Peninsula with surrounding rocks based on geochemical analysis”, IOP Conference Series: Earth and Environmental Science, Vol.88, November 2017. Doi:10.1088/1755-1315/88/1/012014.
- Jamaludin, SN Fathiyah., Mubin, Mukhriz., and Abdul Latiff, Abdul Halim., “Imaging of karsts on buried carbonate platform in Central Luconia Province, Malaysia”, IOP Conference Series: Earth and Environmental Science, Vol.88, November 2017.doi:10.1088/1755-1315/88/1/012011.
- Jamaludin, SN Fathiyah, Abdul Halim Abdul Latiff and Askury A. Kadir “Interpretation of Gas Seepage on Seismic Data: Example from Malaysian offshore” IOP Conference Series: Earth and Environmental Science, Feb.2016. doi:10.1088/1742-6596/660/1/012002.
- Jamaludin, SN Fathiyah., Abdul Latiff AH, Ghosh., DP. 2015. Structural Balancing vs Horizon Flattening on Seismic Data: Example from Extensional Tectonic Setting. IOP Conference Series: Earth and Environmental Science 23 (1), 012003. Doi:10.1088-1315/23/1/012003.
- Jamaludin, SN Fathiyah., Pubellier, Manue.l, Menier, David. 2014. Relationship between syn-depositional faulting and carbonate growth in Central Luconia Province, Malaysia. Bulletin of Geological Society of Malaysia, Volume 60, December 2014, pp. 77-83.

## **CV 4 – Andreina GARCIA-REYES**

Citizenship: Venezuelan

Civilian status: Single, 3 children

Address : Equipe de Géosciences Marines, Institut de Physique du Globe de Paris, CNRS UMR 7154, 4 place Jussieu, 75252 Paris Cedex 05, France

Ph.: (33) 1-83957678 email: agarcia@ipgp.fr

### **Education**

2017 (Expected) Ph.D. in Geosciences - Institut de Physique du Globe de Paris

2009 Engineering in Geophysics – Universidad Central de Venezuela

### **Career**

2016-2017 Attaché Temporaire d'Enseignement et de Recherche (ATER) (Research on gravity and magnetic Earth fields / Electric, electromagnetic and radar imaging / Master 1 level)

2013-present Project engineer / Bolivarian Agency for Space Activities – Science and Technology Ministry, Venezuela (on unpaid leave)

2010-2013 Project engineer / Bolivarian Agency for Space Activities – Science and Technology Ministry, Venezuela

2011-2012 Assistant Professor (Ad Honorem) / Central University of Venezuela / Basin analysis from potential field data

2012 Auxiliary Professor / Hydrocarbons University of Venezuela / Petroleum Research Institute of Venezuela (INTEVEP)

### **Research Interests**

Geophysical prospecting, geodynamics, plate tectonics, potential field data processing and interpretation (gravity and magnetic), magnetic mapping.

### **Publications - selection**

GARCIA-REYES, A., DYMENT, J., & THEBAULT, E. (2016, February). Geophysical interpretation of the Caribbean plate and the Gulf of Mexico from reprocessed potential field data. In AGU Fall Meeting Abstracts.

GARCIA, A., DYMENT, J., & THÉBAULT, E. (2015, April). Processing of the marine magnetic anomalies of the Caribbean region and the Gulf of Mexico (GOM). In EGU General Assembly Conference Abstracts (Vol. 17).

ORIHUELA, N, GARCÍA, A. & M. ARNAIZ (2015) Anomalías magnéticas bandeadas de la placa Caribe in: SCHMITZ, M., AUDEMARD, F. & F. URBANI, El límite noreste de la placa Suramericana - Estructuras litosféricas de la superficie del manto. Central University of Venezuela and FUNVISIS, Caracas, Venezuela.

ORIHUELA, N & GARCÍA, A. (2015) Euler deconvolution to gravimetric data of the Central segment of the Caribbean plate southern edge. Boletín de Geología, Santander University, 37(2), 25-39

LINARES, F., ORIHUELA, N., GARCÍA, A., & AUDEMARD, F. (2014). Generación del mapa de basamento de la Cuenca de Falcón a partir de datos gravimétricos de modelos combinados. Geociencias Aplicadas Latinoamericanas, 1(2), 9-19.

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ORIHUELA, N, GARCÍA, A., TABARE, T (2011) Mapas de gravedad y anomalía gravimétrica de Venezuela derivados de datos satelitales. Revista de la Facultad de Ingeniería. Central University of Venezuela. Caracas. Venezuela. ISSN/ISBN.

0798-4065. p. 1-8.

## CV 5 - Christian ROBERT

### Professor, retired from École normale supérieure, France

Birth : 14<sup>th</sup> December 1947  
Citizenship French  
Civilian status Married, 3 children

### Education

1981 Ph. D. University Pierre et Marie Curie, Paris  
1975 Agrégation Sciences Naturelles, option Sciences de la Terre

### Employment History

1998-2014 : Professor. Ecole normale supérieure, Paris  
1989-1998 : Professor. Institut Universitaire Formation des maîtres, Créteil  
Associate Professor. Ecole normale supérieure, Paris  
1987-1988 : Chargé de Recherche CNRS. Ecole normale supérieure, Paris  
1979-1986: Professor Ecole normale, Créteil

### Publications (selection)

**Robert C.**, Javoy M., and Kienast J.R., 1985. Coefficients de distribution et mesures isotopiques  $^{18}\text{O}/^{16}\text{O}$  : comparaisons thermométriques et barométriques sur les éclogites et micaschistes de la zone Sesia-Lanzo (Alpes italiennes). *Bull. Mineral.*, 108, 699-711.  
**Robert C.**, Goffé B. and Saliot P., 1988. Zeolitisation of a basaltic flow in a continental environment: an example of mass transfer under thermal control. *Bull. Mineral.*, 111, 207-223.  
Robert C., 1988. Barian phillipsite and syntonian chabazite from the Plateau des Coirons, Ardèche, France. *Bull. Mineral.*, 111, 671-677.  
**Robert C.**, and Goffé B., 1989. Transport de Si, Al, Ca en conditions hydrothermales de basse temperature: étude expérimentale préliminaire de la zéolitisation en eau douce. *C. R. Acad. Sci* ;, 309, II, 1803-1809.  
**Robert C.**, et Michard A., 1991. La géologie, science expérimentale. *Géologues. Revue de l'Union française des géologues*, 96, 51-58.  
**Robert C.**, and Goffé B., 1993. Zeolitization of basalts in subaqueous freshwater settings: field observations and experimental study. *Geochim. Cosmochim. Acta*, 57, 3597-3612.  
Robert C., 2001. Hydrothermal alteration process of the tertiary lavas of Northern Ireland. *Mineralogical Magazine*, 65,4, 543-557.

### Books

**Robert C.** and Bousquet R., 2013. Géosciences. La dynamique du système Terre (Textbook in french). *Belin*, Paris, 1159 pp.  
**Robert C.** and Bousquet R., 2017. Geowissenschaften. Die Dynamik des Systems Erde (Textbook in german). *Springer-Spektrum*, Heidelberg.

### Maps

Bousquet R., S.M. Schmid, G. Zeilinger, R. Oberhänsli, C. Rosenberg, G. Molli, **C. Robert**, M. Wiederkehr and P. Rossi, 2012. Tectonic Framework of the Alps, Equidistant conic projection, scale : 1/1.000.000 (125 x 100 cm), published by CGMW and UNESCO - *Commission for the Geological Map of the World*.  
Bousquet R., R. Oberhänsli, S.M. Schmid, A. Berger, M. Wiederkehr, **C. Robert**, A. Möller, C. Rosenberg, G. Zeilinger, G. Molli and F. Koller, 2012. Metamorphic Framework of the Alps, Equidistant conic projection, scale : 1/1.000.000 (125 x 100 cm), published by CGMW and UNESCO - *Commission for the Geological Map of the World*.

### Meetings

La Formation des Chaînes de montagnes. 2014, Meeting, Ecole normale supérieure, Paris  
La géologie des Alpes / Les chaînes de montagnes. 2016 and 2017. Mission française. Lycée français de Rabat, Maroc.



## **9. ATTACH LETTER OF ENDORSEMENT OF IGCP/IUGS NATIONAL COMMITTEE**

*Every co-leader should obtain a letter of endorsement of its IGCP National Committee or IUGS National Committee, where such National Committees exist.*

Letter has been asked requested and will be sent separately

## **10 .SIGNATURE PART**

It is understood that the project leader will be responsible for the submission of annual progress reports, financial statement(s) on the use of IGCP funds, as well as bibliographic data of all publications dealing with the results or activities of the project, all announcements of international public activities which may be connected with the project, such as conferences, field trips, workshops and courses, and a detailed final report when the project has been finished.

It is understood that the project leader(s) will inform the IGCP and/or IUGS National Committees of its own country about his/her project. The project leader(s) will encourage each project participant to inform their IGCP and/or IUGS National Committees about their participation in the project. The project leader(s) will also always inform the IGCP and/or IUGS National Committees of the country where they will be having a meeting, workshop or other project related activity.

It is further understood that the results of the project will be published, preferably in international peer-reviewed publications.

It is further understood that each publication resulting from the project has to carry, at a prominent place, a statement that it is a contribution to the International Geoscience Programme, specifying the number of the project.

In books resulting from the project, the title page and, when technically possible, the cover should also carry the official logo of the IGCP.

It is also understood that the project shall publish at least one scientific paper in the journal 'Episodes'.

**With this signature I confirm that the co-leaders listed above have officially agreed to participate in this project.**

**Date: 13 /10/2017**

**Signature:**



**Appendices** (*check the box if document is attached or included*):

Curriculum Vitae of all co-leaders (included)



Letters of endorsement of IGCP/IUGS National Committee of every co-leader

