

Developing a Toolbox for Managing International Collaborative PhD Programmes

Session 7: The use of the Toolbox (towards achieving the goals of collaborative PhD programmes – graduating excellent PhD researchers through informed and excellent supervision)

Session facilitator – Peter Meissner (UCT)

27th June 2019, Cape Town



Developing the internationalization
of PhD studies in South Africa



Co-funded by the
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Developing a Toolbox for Managing International Collaborative PhD Programmes

A student's view of the advantages/disadvantages of
international collaborative PhD programmes

Matthew Jason Mayne
Stellenbosch University



Disclaimer

Everything you are about to hear is the
uninformed opinion of a recent graduate.

This is purely the student point of view

- **Development of new software tools for phase equilibrium modelling in open systems**

M. J. MAYNE

Supervised by: G. STEVENS, J.-F. MOYEN, T.E. JOHNSON



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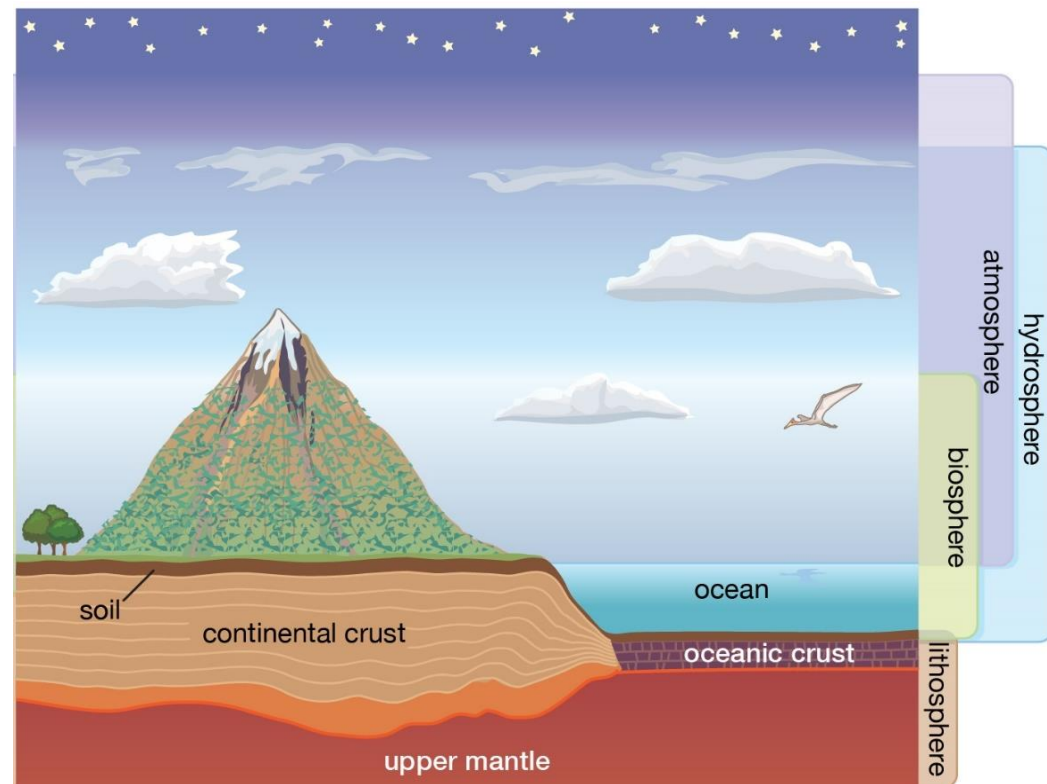
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Geochemical processes in the crust

Geochemical processes in the crust are integral to understanding the formation and evolution of the Earth

- Geochronological rock record
- Pressure & temperature of Earth's interior
- Fluid generation/consumption
- Global geochemical cycles
- Implications for global climate and conditions for life



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Timeline of exchange

- 2014 – BScHons met Jean Francois Moyen at conference (first 3 week research visit in France)
- 2015 – MSc 3 months
- 2016-2018 10 months over 3 years

The numbers

- R 1 122 000 in bursaries and research costs
- Presented or worked in 10 countries: Austria, Australia, England, France, Germany, Ireland, Scotland, South Africa, Swaziland, Switzerland
 - 11 Conference presentation
 - 7 Field trips
- 4 submitted manuscripts to international Q1 journals
 - Admittedly only 2 of those published so far (publishing always takes longer than students plan for)
- 1 Software program publication with >20 current users

Advantages

What can a cotutelle “that works”
provide

Research Group

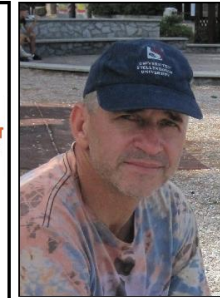
Joint PhD degree programme in petrology at the University Jean Monnet, Saint Etienne and Stellenbosch University

Overarching research objectives:

- How and when did the continental crust originate?
- How does recycling of the continental crust occur in detail?
- How do both processes control the distribution of heat producing elements, particularly K, Th and U?

Contribution to capacity building in both countries:

- Produce PhD graduates who are excellent petrologists and who can make a substantial contribution to discovering new resource reserves through their understanding of crustal evolution.
- Produce at least some PhD graduates who will become leading international scientists.
- Raise the profile of Earth Science in both countries by the quality of work conducted by the group and by highlighting the exceptional natural laboratories for crustal evolution that exist in South Africa and France.



Prof Gary Stevens
Stellenbosch



Prof J-F Moyen
Saint Etienne

Joint PhD graduates (publications in red):



Arnaud Villaros

Lithos, 2009
Contributions to Mineralogy and Petrology 2009
Contributions to Mineralogy and Petrology 2012
Mineralogy and Petrology 2012



Cynthia Sanchez Garrido

Geology, 2011



Gautier Nicoli

Journal of Metamorphic Geology, 2014
Contributions to Mineralogy and Petrology, 2014
Precambrian Research, 2014
Journal of Metamorphic Geology, 2017
Scientific Reports, 2016
Precambrian Research, 2016



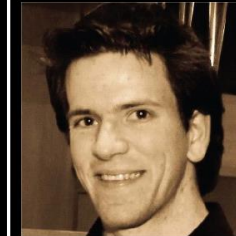
Adrien Vezinet

Precambrian Research, 2014
Precambrian Research, 2016
Precambrian Research, 2017
Journal of Metamorphic Geology, 2017



Simon Cousinie

Precambrian Research, 2016
Earth and Planetary Science Letters, 2016
Lithos, 2017
International Journal of Earth Sciences, 2017
Gondwana Research, 2017



Matt Mayne

Journal of Metamorphic Geology, 2016
Journal of Metamorphic Geology, 2017



Moritz Muhlberg

Current joint PhD students:



Oscar Laurent

Lithos, 2011
Precambrian Research, 2013a, b
Lithos, 2014a, b
Precambrian Research, 2014

Key findings:

1. During crustal differentiation magma is resident in the source for an extremely short time. Consequently, trace-element, isotopic and major element equilibrium is commonly not attained between extracted magma and the residuum with which it coexisted in the source;
2. Limpopo granulite facies metapelites form a thrust sheet that was tectonically emplaced over the amphibolite facies grey gneiss basement;
3. Leucosomes in granulite facies migmatites, in some cases, represent felsic residuum and the volume of such material does not represent the volume of melt which was not extracted from the source following segregation;
4. The return of crustal material to the crust, as magma comprising crustal and mantle components, after continental crust was recycled into the mantle by subduction, triggers crustal differentiation through the introduction of water and potassium. In such cases growth of the continental crust is isotopically "invisible";
5. The software Rcrust has been created for phase equilibrium modelling with changing bulk composition;
6. Melt extraction on the prograde path dramatically reduces the viability of melt production by decompression melting;
7. Granites sensu stricto were produced in the paleo-Archean, most likely by high pressure melting of phengite-bearing assemblages.

Graduated group

Pursued
work
outside
of
Geology

Engineer LA ICP-MS
Institute Freiberg for Resource Technology

PostDoc
University of Cambridge

PostDoc
University of Alberta

Teaching Fellow (professeur agrégé)
University of Lorraine

Lecturer
Stellenbosch University

PhD student
SU and UJM

Joint PhD graduates (publications in red):



Arnaud Villaros

Lithos, 2009
Contributions to Mineralogy and Petrology, 2009
Contributions to Mineralogy and Petrology, 2012
Mineralogy and Petrology, 2012



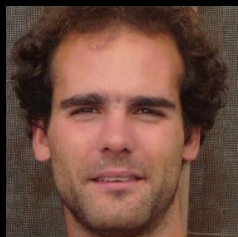
Cynthia Sanchez Garrido

Geology, 2011



Gautier Nicoli

Journal of Metamorphic Geology, 2014
Contributions to Mineralogy and Petrology, 2014
Precambrian Research, 2014
Journal of Metamorphic Geology, 2017
Scientific Reports, 2016
Precambrian Research, 2016



Adrien Vezinet

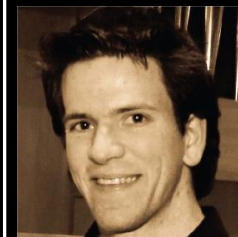
Precambrian Research, 2014
Precambrian Research, 2016
Precambrian Research, 2017
Journal of Metamorphic Geology, 2017



Simon Cousinie

Precambrian Research, 2016
Earth and Planetary Science Letters, 2016
Lithos, 2017
International Journal of Earth Sciences, 2017
Gondwana Research, 2017

Current joint PhD students:



Matt Mayne

Journal of Metamorphic Geology, 2016
Journal of Metamorphic Geology, 2017



Moritz Muhlberg



Oscar Laurent

Lithos, 2011
Precambrian Research, 2013a, b
Lithos, 2014a, b
Precambrian Research, 2014

Research Fellow (chargé de recherche)
Université de Toulouse (CNRS)

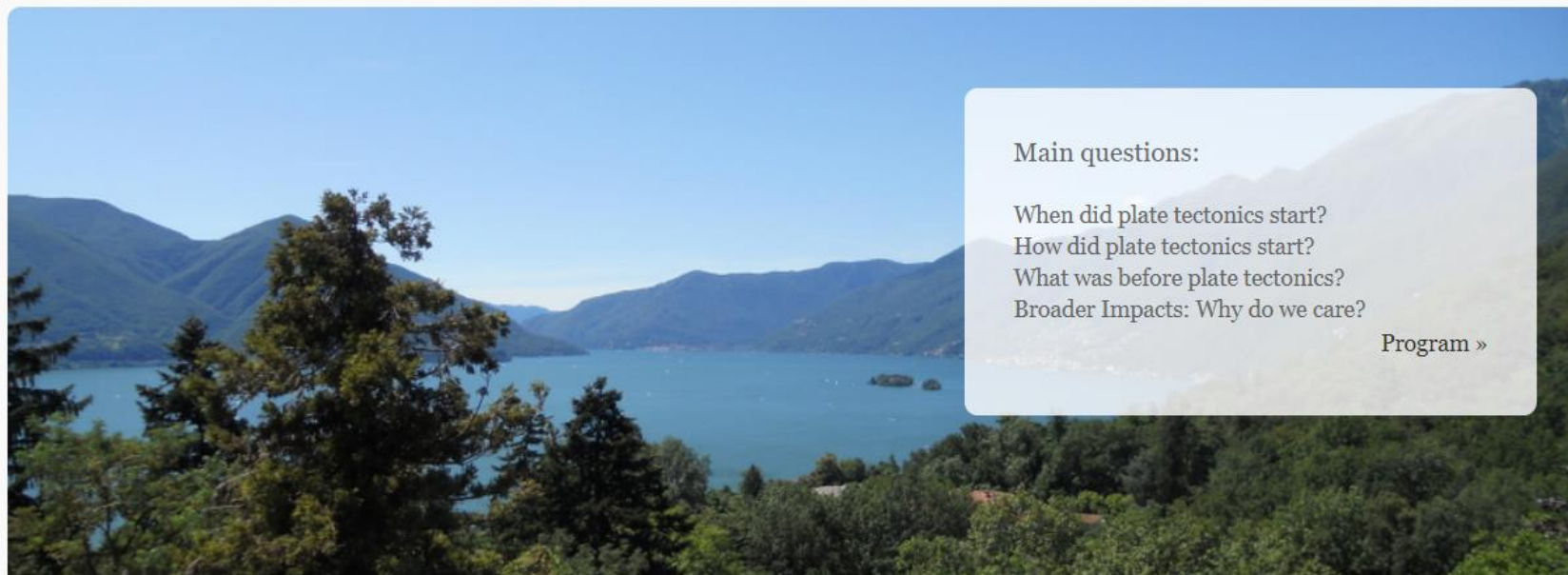
- Summer conferences (fieldwork) Dec-Jan in South Africa, Jun-Jul Europe
 - Access to field areas where flights are already paid
 - Extended research stays to have holidays where I explored Europe
 - Collaborated with multiple universities outside of the cotutelle
- ** Essential that travel is autonomous, only I understood why and when I needed to travel, the freedom I was afforded to do this allowed me to benefit from every trip

International conferences and workshops

WORKSHOP ON THE ORIGIN AND EVOLUTION OF PLATE TECTONICS

17-22 July 2016

Congressi Stefano Franscini, Monte Verità, Locarno, Switzerland

[HOME](#)[PROGRAM](#)[ABSTRACT & REGISTRATION](#)[CONFERENCE CENTER](#)[GETTING THERE](#)[PARTICIPANTS](#)

Main questions:

When did plate tectonics start?

How did plate tectonics start?

What was before plate tectonics?

Broader Impacts: Why do we care?

[Program »](#)

**MAIN TOPICS OF THE
WORKSHOP**

**WHEN DID PLATE
TECTONICS START?**

**HOW DID PLATE
TECTONICS START?**

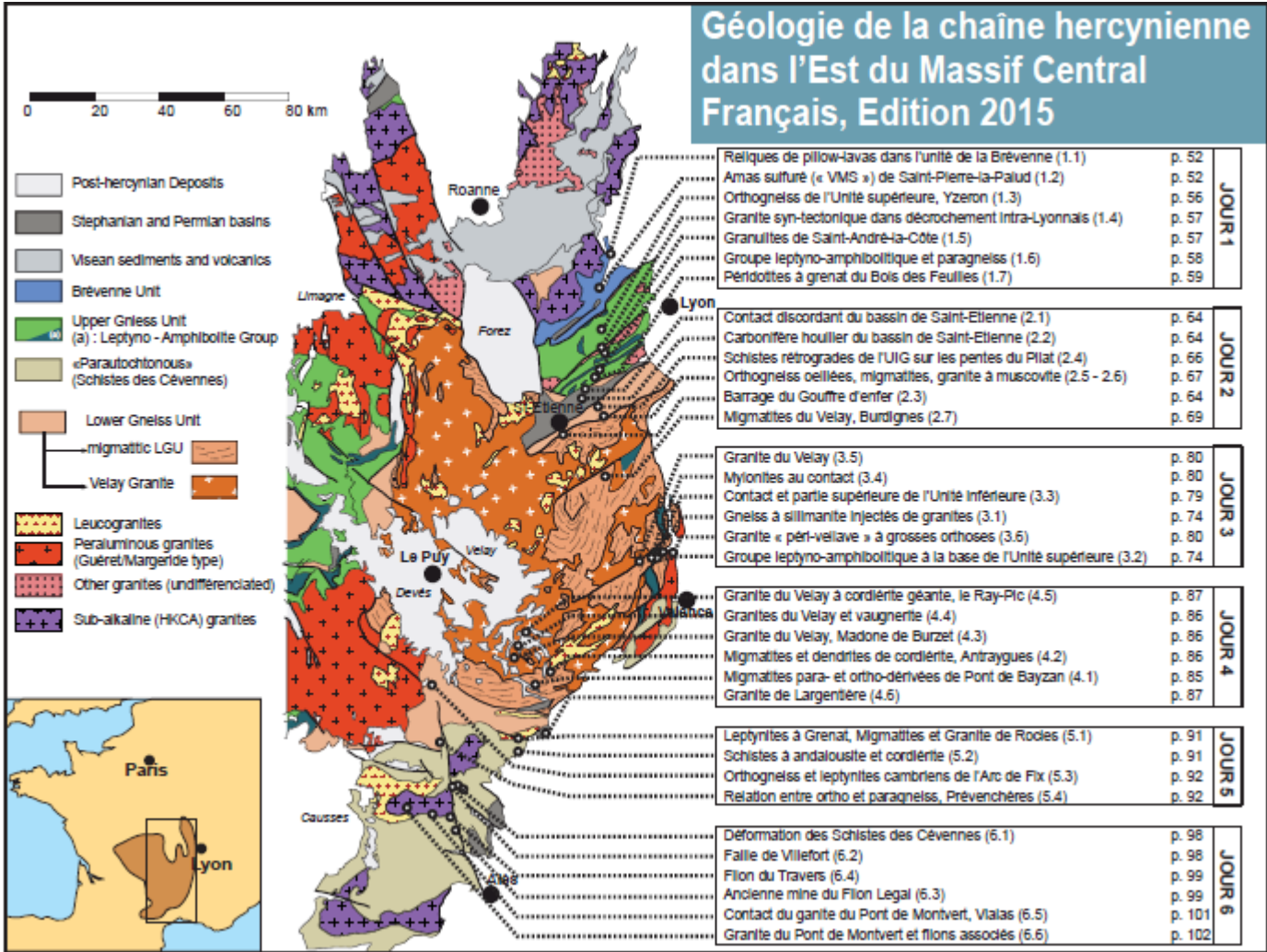
**WHAT WAS BEFORE
PLATE TECTONICS?**

**BROADER IMPACTS: WHY
DO WE CARE?**

International conferences and workshops



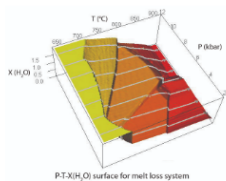
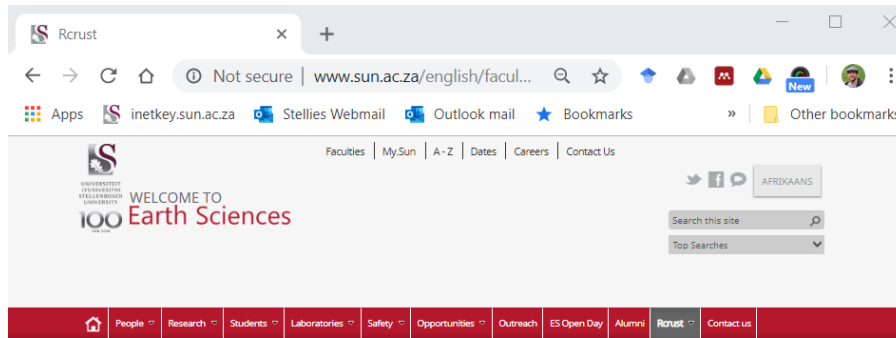
International exposure to field locations



Shared facilities



Reaching multiple audiences



Rcrust is a free software tool that performs phase stability calculations with path dependence. In these calculations pressure (P) temperature (T) and bulk composition (X) can vary simultaneously.

Rcrust is free to Download and use under the GNU copyleft.

About & Getting started

Rcrust is a thermodynamic modelling tool that uses a compiled form of "meemum" from the Perple_X suite of programs to calculate the phase stabilities of points in P-T-X space. The strength of "Rcrust" is that it allows

Download & useful links

Read more about the download of the program, the manual and other useful links.

Citing & Licence

Find information on appropriate references for calculations performed with Rcrust as well as:

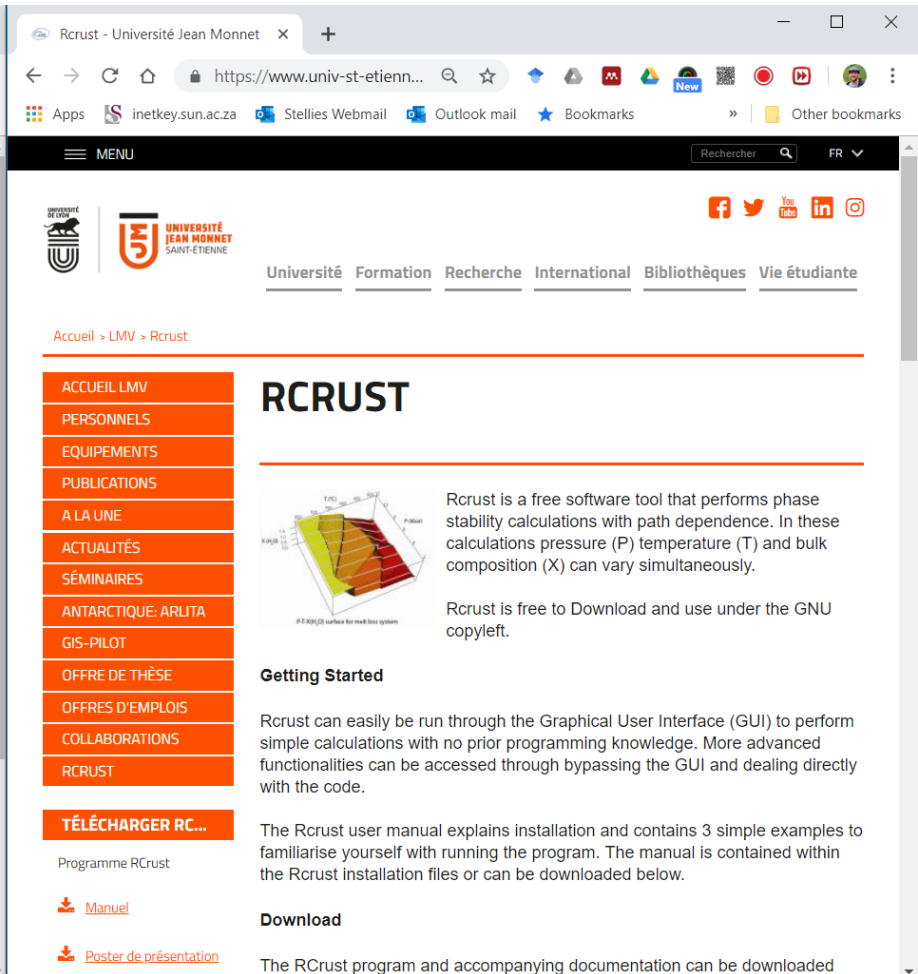
Underlying Perple_X calculations,
R language
Licence

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Professor Gary Stevens
Stellenbosch University (South Africa)
gs@sun.ac.za

Lars Kalsilaniemi



International collaboration on publications

Journal of METAMORPHIC GEOLOGY

J. metamorphic Geol., 2016

doi:10.1111/jmg.12199

Rcrust: a tool for calculating path-dependent open system processes and application to melt loss

M. J. MAYNE,^{1,2} J.-F. MOYEN,² G. STEVENS¹ AND L. KAISLANIEMI³

¹Department of Earth Sciences, Center for Crustal Petrology, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa (m.j.mayne@outlook.com)

²University Lyon, UJM-Saint-Etienne, UBP, CNRS, IRD, Laboratoire Magmas et Volcans UMR 6524, F-42023, Saint Etienne, France

³Department of Geosciences and Geography, Institute of Seismology, University of Helsinki, Gustaf Hållströmin katu 2b, 00014, Helsinki, Finland

Performing process-oriented investigations involving mass transfer using Rcrust: a new phase equilibrium modelling tool



MATTHEW JASON MAYNE^{1,2*}, GARY STEVENS¹,
JEAN-FRANÇOIS MOYEN² & TIM JOHNSON³

¹University of Stellenbosch, Department of Earth Sciences, Private Bag X1, 7602 Matieland, South Africa

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³Curtin University, Department of Applied Geology, WA 6845 Perth, Australia

Received: 6 December 2016 | Accepted: 27 July 2017

DOI: 10.1111/jmg.12265

ORIGINAL ARTICLE

WILEY **JOURNAL OF METAMORPHIC GEOLOGY**

Insights into the complexity of crustal differentiation: K₂O-poor leucosomes within metasedimentary migmatites from the Southern Marginal Zone of the Limpopo Belt, South Africa

G. Nicoli^{1,2} | G. Stevens¹ | J.-F. Moyen² | A. Vezinet² | M. Mayne^{1,2}

A phase equilibrium investigation of selected source controls on the composition of melt batches generated by sequential melting of an average metapelite

Matthew Jason Mayne^{1,2,*}, Gary Stevens¹ & Jean-François Moyen²

¹University of Stellenbosch, Department of Earth Sciences, Private Bag X1, 7602 Matieland, South Africa

²Université de Lyon, Laboratoire Magmas et Volcans, UJM-UCA-CNRS-IRD, 42023 Saint-Etienne, France

The trajectory of the *P–T* path controls the onset of melting in metasedimentary rocks.

M.J. Mayne^{1,2,*}, G. Stevens¹, J.-F. Moyen², and T.E. Johnson³

¹ Department of Earth Sciences, Stellenbosch University, Stellenbosch, 7602, South Africa

² Université de Lyon, Laboratoire Magmas et Volcans, UJM-UCA-CNRS-IRD, 23 rue Dr. Paul Michelon, 42023 Saint Etienne, France

³ Department of Applied Geology, Curtin University, Perth WA 6845, Australia.

- French PhD defence
- Networking
- Invited future employers

Student presentations

- IOM3 YPLC



Student presentations

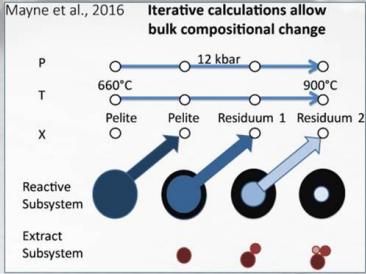
- IOM3 YPLC
- Fame lab



Student presentations

- IOM3 YPLC
- Fame lab
- Weekly Seminars
- Self organised talks
(job hunting offer
talks)

PT path dependence of anatexis during fully-hydrated, fluid-absent prograde metamorphism in the upper-amphibolite facies

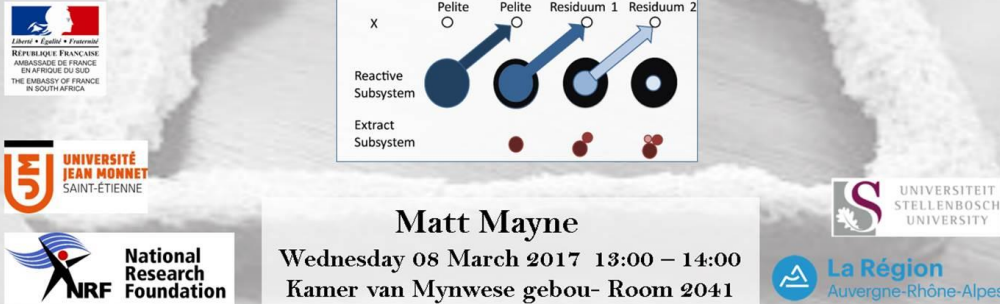


Mayne et al., 2016 Iterative calculations allow bulk compositional change

P 12 kbar
T 660°C 900°C
X Pelite Pelite Residuuum 1 Residuuum 2

Reactive Subsystem
Extract Subsystem

Matt Mayne
Wednesday 08 March 2017 13:00 – 14:00
Kamer van Mynwese gebou- Room 2041



- If you reduce your research costs to your supervisor they will reinvest this in you and trust that the money is well spent
 - Blabla car
 - Flixbus / eurolines (free night accommodation)
 - Couch Surfing
 - Colleagues
 - Airbnb

Multiple funding agents

- French Embassy of South Africa
- Campus France
- PGIO/KIC travel grant 1 per PhD
- Memberships





Associations



- Royal society of South Africa
- EGU
- Institute of Materials, minerals and mining
- Geological Society of South Africa

- Can give funding, fieldtrips, networking

- LIA
- French SA exchange
- Czech geological survey



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2 Laboratoire Magmas et Volcans, Université Jean Monnet, France

3 Czech Geological Survey, Prague 118 21, Czech Republic

Adding trace elements to phase equilibria modelling. A method in Rcrust utilising partition coefficients and accessory phase saturation



Rcrust

Free to download at
<https://tinyurl.com/Rcrust>

Disadvantages/ Challenges

Learning from my mistakes

- Could not attend French language classes in France as I was not allowed to do course work
 - Tried to sign up for extra curricular French classes but semester schedules were offset
- Major differences between the French and South African semester schedules

Administrative difficulties

- Essentially all forms were in French
 - Ensure there is help available for the student to complete admin e.g. residence
 - French Embassy and Campus France helped a lot here
- Cotutelle agreement only signed in the year of graduation
- Never received a student card in France -> difficulties with eating, printing, etc
 - Research group helped out here
- Was not given access to Eduroam
 - This should be a prerequisite
 - Also provide library logins for articles

Transport difficulties

- South Africans have never been exposed to public transport
 - Ensure first visit is assisted by a competent travel agent or directly assisted by supervisor
 - This must be all the way from their University to yours (I arrived in Paris not Saint Etienne)
 - Even taking a bus from the train station to a residence is daunting the first time with language barriers + different money +different system + no cellphone connection

Importance of the Research Group

- There will be challenges not foreseen/experienced by the supervisors
 - Every time this happened I always had my research group to fall back on they provided:
 - Lifts
 - Advice
 - Couches to sleep on
 - Friends and introductions (exchange can be very lonely)
 - They have French banks and French addresses so can help with admin that I was not legally able to do (e.g. get a sim card)
 - Must encourage a research group culture with participants in both directions (braais, outings, fieldtrips, volunteer to help on their projects)

- Exchange takes up a lot of time
- Delayed my studies + 1st year PhD
different direction in research
 - However, learnt critical networking skills
 - Expanded view on research
 - Exposed to new cultures
 - Learnt to live in a foreign environment

- Should mandate a 3 monthly progress report from the student which both supervisors have to comment on and accept
- Encourage communication between all parties

6.4.3 PhD in Geology

Programme Code

13374 – 978 (360)

Programme Description

A dissertation that is the product of your personal and independent research is required. See also section 2.3 in this chapter for general information on the PhD degree in the Faculty of Science.

6.4.4 DSc in Geology

Programme Code

13374 – 998 (360)

Programme Description

A compilation of scientific publications contributing substantially and at a high level to the body of knowledge in Geology, is required from you. See also section 2.4 in this chapter for general information on the DSc degree in the Faculty of Science.

Difficult to understand the criteria for graduation

2.4.4 You must submit one copy of the work(s) that you want to present per examiner before 1 September (if you want to graduate in December) or before 1 December of the previous year (if you want to graduate in March) at the University office. The copies must be accompanied by a written statement that it is your original work and that the work has not been submitted to this or any other university for the purpose of obtaining any degree. If a substantial part of the submitted work was published under your name and that of another

- French criteria mandated a formal defence and jury nomination 3 months before the defence



No formal recognition for supervisory experience



- Was never recognized for my supervisory experience
- This became an issue when searching for jobs

- Difficult to know who to cite
 - Make it clear from the beginning who to cite where and how
 - Provide official logos and wording e.g. NRF
 - Often had multiple funding sources so these can work together to share in the rewards and split the costs

Employers in Academia are looking for:

1. Teaching experience
2. Research profile and supervision
3. Ability to attract funding
4. Community engagement

Cotutelles help in providing all of these criteria



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Thank you



YEBO!



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