

Sébastien Pilet receives 2006 Paul Niggli Medal



The board of the Paul Niggli Foundation has decided in their annual meeting of 22 June 2006 to award the Paul Niggli Medal 2006 to Sébastien Pilet, born 10 August 1970, in recognition of his original research on basalt petrogenesis and the geochemistry of the Earth's mantle. His research is based on petrographic and mineral-chemical evidence for a significant role of mantle metasomatism in

the generation of ocean island basalts. The medal was awarded at the 4th annual Swiss Geoscience Meeting in Bern, on 24 November 2006, by Lukas Baumgartner and Christoph Heinrich on behalf of the Paul Niggli Foundation.

Citation

Sébastien Pilet was born in Lausanne in 1970. He did his secondary schooling in Lausanne and started studying at the faculty of Sciences, University of Lausanne, in 1990, where he had an exceptional career.

In 1996, Sébastien Pilet and Annabelle Collomb (now Collomb Pilet), began a diploma project in the central part of the Cantal volcano in the Massif Central of France.

For some obscure reasons, French geologists neglected this part of the Cantal, thus missing the strange geochemical evolution of the intermediate-composition lavas that had never been studied from a geological and petrological point of view.

During this adventure, concluded in 1997 with an outstanding diploma thesis and a map later used by the BRGM, Sébastien and Anabelle discovered the importance of green core clinopyroxenes in the genesis of alkaline basalts. These green clinopyroxenes are characterized by their phonolitic affinities and they are always rimmed by augite that formed at

lower pressures in equilibrium with the enclosing lava. Such green xenocrysts were known for a long time, but their origin was debated, and their role in the evolution of basaltic magmas was not constrained. Sébastien Pilet and Anabelle Collomb suggested that the green cores represent a metasomatic phase present in veins in the lithospheric mantle and formed during an earlier stage of Cantal magmatic activity.

In his PhD thesis on the petrology of alkaline basalts in the Cantal, Sébastien demonstrated clearly, and for the first time, the metasomatic nature of these pyroxenes. He proposed that the green pyroxene cores crystallized from a melt in the lithospheric mantle by “percolative fractional crystallization”, according to a process proposed by Harte et al. in 1993. Sébastien found that the Nb and Ta enrichment observed in the second and last episode of basaltic eruption in the Cantal were the clue to a metasomatic event in the magma source. He suggested that the source of Cantal basalts was not asthenospheric, as commonly assumed, but a heterogeneous lithospheric source composed of metasomatic veins enclosed in depleted peridotite. Moreover, he demonstrated that the composition of these veins evolved during the massif magmatic activity.

Sébastien further showed that the evolution of these veins controls the trace element ratio of the source, in particular the radiogenic isotopic systems Rb/Sr, Sm/Nd and U/Pb. The work of Sébastien Pilet strongly suggests that some globally-observed isotopic endmember signatures (especially EM1 and HIMU) could be the trace of metasomatic imprints within lithospheric mantle, rather than a mixing between different recycling components.

To extend his hypothesis, Sébastien decided to carry on with two directions of postdoctoral research. The first project was to study the trace elements in the metasomatic minerals in the laboratory of Paul Sylvester in Newfoundland by using the laser ablation ICP-MS technique. The second project was an experimental study to clarify the process of percolative fractional crystallization, in collaboration with Peter Ulmer's laboratory at ETH Zurich.

Currently, Sébastien is performing experimental work in the laboratory of Edward M. Stolper at Caltech, in order to

explore his alternative hypothesis for the origin of alkaline lavas. This work is supported by a Swiss National Science foundation grant for advanced researchers.

In my opinion, there are two big categories of researchers: a first one that stabilizes theories with new data and a second one that produces new ideas that change the foundations of the theories. Sébastien Pilet belongs clearly to the second category, and I am happy that the Niggli committee recognized a young talented scientist.

Jean Hernandez, Université de Lausanne.

Response

I would like to express my gratitude to the members of the Paul Niggli foundation for this award. Receiving this medal is an incredible message of encouragement for my work. However the term “work” seems not appropriate in my case, because my work is, in fact, my passion.

Unlike some other scientists who were born with geology or mineralogy in their blood, I have never dreamed as a child of becoming a petrologist. I initially decided to study mathematics at the University of Lausanne after much hesitation with physics and chemistry. But after one year of equations and a long trek in Iceland, I have realized that geology was the science offering the best choice to combine my various interests. 15 years later, I continue to think it’s true.

The origin of continental and oceanic volcanism is my main research interest. What is the source of alkaline lavas? Why are their composition so different from the basalt emitted at mid ocean ridge? Is their emission controlled by tectonic process or related to some deep hot spot? These are some of the questions that I try to answer. For these issues I use various constraints like field observation, mineralogy, whole-rock and mineral chemistry, radiogenic and stable isotope chemistry and, now, experimental petrology. This combined approach corresponds to my scientific “philosophy”, which suggests that a scientific problem, in particular for natural systems, can be constrained only using various and complementary methods.

This approach invites collaboration with different people. It is a great chance, and I am grateful to all of them for their interest and support. I would like in particular thank the following people which have played a significant role in my scientific life.

First, I would like to thank Jean Hernandez. Jean has played a crucial role in my life, because he was the person who introduced me to mineralogy and petrology. Jean was in fact the person who transmitted to me the virus of igneous petrology. I also thank him for his constant support during all these years.

The second person I would like to thank is François Bussy. François also contributed to my interest for igneous petrology, and has followed my work with a lot of interest. François was one of my first scientific role models, for his rigor during data acquisition and treatment, and by his very interesting approach to the geological problems.

Paul Sylvester was my advisor at Memorial University of Newfoundland. He provided me the best conditions possible to accomplish my research project and helped me to realize that my initial model for the origin of Cantal alkaline lavas could have a significant impact on mantle evolution and geochemistry in general. He also taught me how to manage an analytical laboratory.

The interest of Peter Ulmer in my work was another source of motivation. Our discussions and the possibility to come to ETH Zürich, to test experimentally some of my ideas, was both stimulating and fruitful.

Edward Stolper is my current advisor at California Institute of Technology. Ed is simply the most amazing scientist I have ever met. His combination of open-mindedness and scientific rigor is the example to follow. I would like to thank him for the confidence and practical help that he and my fellow researchers at Caltech gave me, in particular also M.B. Baker and S. Newman.

The excellent atmosphere which exists in the Swiss petrological community is also a source of motivation. I always appreciate our annual “journée magmatique” and the very stimulating discussion during and after the different conferences. Moreover, during the last years, my project has required various analyses or experiments which could not be performed “at home”. For every analytical request, I have received a positive answer and all the help I needed to obtain the best analytical results possible. I thank in particular, D. Fontignie (University of Geneva), J. Kramers (University of Bern) and S. Villiger (ETH Zürich) for their help.

I would like to thank also the Swiss National Science Foundation for its support. The SNF fellowships for young scientist are exceptional opportunities to develop one’s own research in other countries. I will probably remember the two post-docs in Canada and in California as some of the most interesting years in my life.

And finally I would like to thank my family and particularly my wife Anabelle. The opportunity to work at universities at the other side of the globe is a great chance for a young scientist, but the implication for the family is significant. So I really thank my wife for accepting to follow me around the world and to accepting to make a break in her own career as a hydrogeologist. Thank you all!

*Sébastien Pilet, California Institute of Technology,
Pasadena, USA.*