EXTENSION AND EXHUMATION OF THE HELLENIC FOREARC

AND

RADIATION DAMAGE IN ZIRCON

by

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A Dissertation

Submitted to the University at Albany, State University of New York

in partial fulfillment of

the Requirements for the degree of

Doctor of Philosophy

College of Arts & Sciences

Department of Earth and Atmospheric Sciences

2008

Abstract

Mapping and new structural observations on Kythera demonstrate the presence of a major detachment fault, which borders the domed structure of a metamorphic core complex. A three stage extensional context accompanied the exhumation of HP-rocks in Kythera. Early ductile structures near the mapped detachment fault indicate its initiation under NE-trending extension. Later ductile, ductile-brittle and some brittle structures, in the metamorphic unit near the detachment, indicate a significant NW-SE extension along-the-arc. The youngest brittle structures indicate return to NE-SW extension.

Thermochronological and structural data show the intensive extension along-the-arc in the Kythera area fades out in both directions along the Cretan-Peloponnese ridge. The exhumation of HP-rocks in the Hellenic forearc ridge and arc-parallel extension in the Hellenic forearc ridge are tectonic episodes resulting from simultaneously high rates of trench rollback and slab retreat and consequent expansion of the arc of the overriding Aegean plate and simultaneously, the bending of the arc from a more rectilinear shape. Local arc-parallel extension occurred where stretching was a maximum, and occurred in a position of oblique late convergence along the arc.

Determination of radiation damage (RD) in zircon using Raman spectroscopy and annealing experiments shows wavenumber shifts to correlate strongly with uranium concentration of zircon (Uz). Consequently, Raman spectroscopy of v3[SiO_4] can potentially determine the Uz. There is a progressively increasing range of wavenumber shift due to Uz increase, which reflects the ratio of intact versus distorted crystallinity. The time since crystallization or last annealing of the zircon will control the amount of radiation damage and the Raman wavenumber shift for zircons with a given Uz. A longer time is required for

a low-uranium zircon to reach the same amount of alpha and fission damage events of a high-uranium zircon, in order for both to show equal wavenumber shift. Time distinguishes zircons of same Uz, which show differences in the Raman wavenumber. The correlation of the Raman wavenumber range and Uz may permit the development of a new chronometer using Raman measurements only for determining U concentration.

Acknowledgements

This Dissertation is by far the most significant scientific accomplishment in my life and it would be impossible to have done it without some people who supported me. Foremost, I thank my research advisor, Professor W.S. F. Kidd, for suggesting that I do my graduate research in Kythera island, the Island of my parents' home, my grandparents' home and my best place of vacations and spiritual inspirations. This is the Island of love, of Venus (the goddess of Greek mythology), this is the region where the Antikythera mechanism was found in the bottom of the sea. This Island hosts many secrets, where I did my best to decipher its tectonic mysteries.

I also want to thank both my advisors Bill Kidd and John Garver for their time and patience in listening my ideas and reviewing my Dissertation. Embryonic thoughts need the right guidance to be mature; I thank them for providing me the tools and the means to explore them. I appreciate all of their suggestions on this research, in tectonics, in thermochronology and zircon radiation damage, but also for their experience to deal with unexpected scientific results. This is what makes science so attractive! They were always giving me suggestions for research directions, as they still do. They encouraged me to think through all the scales, since geology is applicable to micro-world, as well as to macro-world. Also, special thanks to John Garver for the funding opportunity to research on radiation damage of zircon.

This thesis has benefited from discussions with Prof. Adam Schoonmaker. I particularly appreciate that even after he left the University at Albany he still advised me where to search or provided me with papers related to Aegean tectonics.

I also thank Prof. Kyriakopoulos of the National & Kapodistrian University of Athens (UOA), Greece for urging me to continue my geological studies overseas and to interact with other scientific faculty in Earth sciences.

I am also very grateful to my friend Matt Montario who have helped me in more ways than can be acknowledged here, Stephanie Perry, David Gombosi and Eva Enkelmann who not just have introduced me to Fission Track Thermochronology, but also, instruct me tricks and how to avoid traps and mistakes. Also, I would like to thank Chul Lim and Jamie Macdonald for assistance on my first steps at the beginning of my research.

I also have a lot of friends nearby Albany who made it much easier to get through hard winters and holidays. I thank Mrs. Maroula Liapis, her sons, Thanassi and Ntino, her many great friends Nancy, Tony and Alice, John and Guen, Robin and Mat.

To my wife Katerina and future colleague in Science, for continuous support and love, these moments, these years of graduate studies were passed like an exciting dream. She made me think that time consumed on studying or working is meaningful when we are together. I also have to say that she was my best partner at the field trips in Kythera Island, she brings me luck to find significant outcrops, though she does not like spiders and especially the snakes, but who does! She was inspiring me by her questions on geology of the Hellenic Arc and leading me, without knowing, to a better understanding. I have to say that she was also studying for her PhD preliminary exams in the Dept. of Mathematics & Statistics even in the 4x4 vehicle during the fieldtrips!

None of this fieldwork on Kythera Island, in the Peloponnese, and on Crete would have been possible without help and support from my local friends and family. I thank my Australian-Kytherean aunt Botitsa, who gave us more than hospitality and the best Kytherean food, at her beautiful house; and my wife's family, cousin-in-law and their parents in my wife's village close to Sparta, in the famous Molaoi, Peloponnese! "Sas afchureesto" which

means in Greek, something a lot more than “thank you!”.

Lastly, I would like to thank those whose spiritual support is even more important. I thank my parents, my brother and all of my grandparents and Greek friends for their support.

This study was supported by the National Science Foundation, American Chemical Sociaty, Geological Society of America, and different units of the University at Albany (FRAP, Graduate Student Organization, and Department of Earth and Atmospheric Sciences).

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