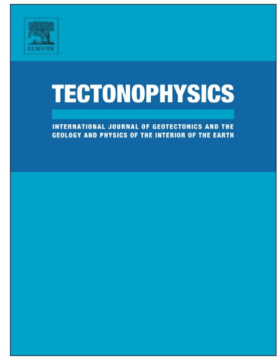
Accepted Manuscript



The timing of high-temperature conditions and ductile shearing in the footwall of the Naxos extensional fault system, Aegean Sea, Greece

Uwe Ring, Johannes Glodny, Alexandre Peillod, Alasdair Skelton

PII: S0040-1951(18)30306-8
DOI: doi:10.1016/j.tecto.2018.09.001
Reference: TECTO 127925

To appear in: *Tectonophysics*

Received date: 1 March 2018
Revised date: 25 August 2018
Accepted date: 3 September 2018

The timing of high-temperature conditions and ductile shearing in the footwall of the Naxos extensional fault system, Aegean Sea, Greece

Uwe Ring[1], Johannes Glodny[2], Alexandre Peillod[1], Alasdair Skelton[1]
[1]Department of Geological Sciences, Stockholm University, 10691 Stockholm, Sweden
[2]Deutsches GeoForschungsZentrum GFZ, Telegrafenberg, 14473 Potsdam, Germany

Abstract: We present eight Rb-Sr multi-mineral isochron ages showing that high-temperature metamorphic conditions and partial melting during top-to-the-NNE extensional shearing in the footwall of the Naxos extensional fault system (i.e. Naxos metamorphic core complex) lasted until about 14-12 Ma. One migmatite sample yielded an age of 14.34 ± 0.2 Ma (2σ uncertainty) for crystallization of migmatization-related melt pockets. Four pegmatite samples, which are in part associated with partial melting of their host rocks, provided overlapping ages ranging from 13.81 to 12.23 Ma (age range includes 2σ uncertainty). Additional three samples of amphibolite-facies schist supplied Rb-Sr ages of around 14 Ma. Samples showing fluid- and/or deformation-assisted white mica and biotite reworking gave Rb-Sr mineral apparent ages of 11.1 ± 2.7, 10.16 ± 0.24, 9.7 ± 0.7 and 9.6 ± 0.15 Ma. These ages are interpreted to be associated with late stages of extensional shearing under greenschist-facies metamorphic conditions. Together with published U-Pb zircon ages of migmatite, and S- and I-type granite crystallization, the data indicate that the presence of melt in the footwall of the Naxos extensional fault system lasted for at least 7 Ma (from ~18 to ~11 Ma). This demonstrates that high temperatures and crustal melting resulting from and aiding extensional deformation was a long-lived and not a transient event. We conclude that melt-assisted deformation facilitated large-scale displacement on the Naxos extensional fault system by drastically weakening the extending crust for long periods of time.

Introduction

Thermal anomalies play an important role in lithospheric deformation, especially when associated with melting, as the latter causes a profound strength reduction (Arzi, 1978; Rosenberg et al., 2007). A dramatic decrease in strength already occurs when the melt fraction is small (Rosenberg and Handy, 2005). The largest viscosity decrease takes place at melt volumes of 1–5%, with a second, less significant drop at 25–30% (Rosenberg et al., 2007). At melt volumes of 1–8%, the strength of rocks decreases to about 10% of its initial value (Rosenberg