Geophysical Research Abstracts, Vol. 7, 10033, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10033

Serifos: New Constraints on Cycladic Exhumation and Magmatism - Implications for Aegean Geodynamics

C. Iglseder, B. Grasemann, K. Petrakakis, M. Thöni, U. Klötzli, A. Zamolyi and C. Rambousek

Structural Processes Group, Department of Geological Sciences, University of Vienna, Austria (a9805002@unet.univie.ac.at)

The Attic–Cycladic massif, part of the Alpine orogen in the eastern Mediterranean is located SE of the Greek mainland trending parallel to the Hellenic volcanic arc. Miocene age exhumation of metamorphic rocks is due to widespread extension associated with low-angle detachment faulting (Lister et al. 1984) probably related to a southwards retreat of the Hellenic subduction zone (Royden 1993) and associated rotation of back-arc crustal blocks (Walcott and White 1998). Some central Cycladic islands (Naxos, Paros and Ios) have been suggested to represent metamorphic core complexes (MCC) associated with asymmetric extension either to the N or to the S (Lister et al. 1984, Gautier et al. 1993). Frequently, these central Cycladic MCCs are characterized by syn- to post-tectonic granitoid intrusions. The former are deformed by an asymmetric main detachment (directed either to the N or to the S), resulting in a discordant (i.e. detachment-cross cutting) contact on one side of the intrusion and a mylonitized, detachment-bounded contact on the other side (Lister et al. 1993). Whole rock and mineral dating of the occurring I-type, and locally S-type granitoids reveal intrusion and cooling ages of 17-5 Ma (Altherr et al. 1982, 2001, Hejl et al. 2002, Henjes-Kunst et al. 1988, Keay et al. 2001, Pe-Piper et al. 1997, 2000).

Our structural mapping as well as petrological, geochronologic and geochemical investigations constrain a hitherto unrecognized multi-stage magmatic and metamorphic core complex in the western Cycladic island of Serifos. In the northern and southwestern parts of the island, a folded metabasite-marble-unit with relict glaucophane is present. This is characterized by a well preserved, E-W-trending older lineation and similarly striking fold axes that pre-dates a multi-stage plutonism and metamorphic core evolution. The plutonism consists of at least two granitoid intrusions, distinguish-

able on the basis of field and textural features as well as geochronologic dating.

The older intrusion initiates contact metamorphism and massive Ca-Fe-Mg endoskarn and exoskarn formation (Salemink, 1985). Formation of the early high-temperature garnet+clinopyroxene endoskarns are affected by a low angle detachment showing consistent high temperature NNE-SSW striking stretching lineation. Spectacular shear sense indicators support SSW-directed kinematic. The early granitoids transform to orthogneisses (lower gneiss unit of Salemink, 1985) and mylonites that locally still preserve magmatic relics. This tectonic event signifies the initial formation stage of the MCC. Rb-Sr muscovite cooling ages from such orthogneisses yield ages of 15-13 Ma.

The later detachment horizon is initiated at greenschist facies conditions during cooling and unroofing of the MCC and evolves to ductile / brittle conditions. It is characterized by the same kinematic pattern as the one in the high-grade mylonites. The southern part of the otherwise undeformed hornblende-biotite-granodiorite is affected by this second exhumation stage of the MCC. At its northern margin, this granodiorite cross-cuts both, the earlier, high-temperature as well as the later greenschist facies detachment. This key switch in the granitoid/detachment cross-cutting relationship impressively demonstrates a syn- to post-kinematic intrusion of the Serifos granodiorite.

The final intrusive phase is accompanied by various dykes ranging in composition from granitic to dioritic and cutting both the granodiorite and the country rocks. They show porphyritic textures and generally contain the same minerals as the granodiorite. However, they differ from the granodiorite by distinctly higher hornblende/biotite-modal ratios. The dykes can be distinguished in terms of textural features, the size of the matrix crystals (micro-crystalline or coarse-grained) and deformation (slightly deformed and undeformed types). These dykes follow brittle joint patterns indicating intrusion at shallow crustal levels.

New geochronologic data based on intrusion ages (single grain zircon TIMS U-Pb) of ca. 11.3 Ma, Rb-Sr biotite cooling ages of ca. 8.0–8.5 Ma and apatite fission-track ages (Hejl et al. 2002) of 5.3–6.7 Ma suggest very high initial cooling rates of $>100^{\circ}$C/Ma followed by slower cooling of $>50^{\circ}$C/km. These figures probably correlate with a two-stage rapid exhumation of the MCC.

The newly identified MCC of Serifos, to our knowledge the first such structure reported for the Western Cylades, extend the ca. 40 km wide belt of known MCCs in the Central Cyclades (Paros-Naxos-Ios) to ca. 150 km further to the west. The geochronologic ages derived there from extend also the time interval for extension to younger ages. It underlines the importance and magnitude of the Aegean extensional tectonic

regime. This western propagation is consistent with, for example, lithospheric models of Jolivet (2001) that invoke the present day (seismically active) extension in the Gulf of Corinth (a further 120 km west of our constraints for Serifos) within the overall E. Mediterranean geodynamic evolution.

Altherr R., Siebel W. 2001. Cont. Min. Pet. 143, 397-415

Jolivet L. 2001. Earth and Planetary Sci. Let. 187, 95-104

Lister G.S. & Baldwin S.L. 1993. Geology 21, 607-610

Pe-Piper G. 2000. Eur. J. Mineral. 12, 859-875

Salemink J. (1985). PhD thesis, University of Utrecht