Geophysical Research Abstracts
Vol. 12, EGU2010-12440, 2010
EGU General Assembly 2010

Granite intrusion in a metamorphic core complex: the example of the Mykonos laccolith (Cyclades, Greece)

yoann Denèle (1), Emmanuel Lecomte (1), Laurent Jolivet (2), Benjamin Huet (1), Loïc Labrousse (1), Laetitia Le Pourhiet (1), and Olivier Lacombe (1)

(1) ISTEP, UMR 7193, UPMC-Paris 6, CNRS, (2) ISTO, Université d'Orléans-CNRS, UMR 6113

Numerical and analogical modelling underlined the importance of a pre-existing anomaly of viscosity-density such as a granite or migmatitic body below the brittle-ductile transition as a primary cause of metamorphic core complex (MCC) developpement. While field studies of MCC show a spatial and temporal link between MCC formation and plutonic activity, thermochronological studies show that there is no link between the intrusion of granites and the velocity of slip on the detachement plane.

The Aegean domain is a good natural laboratory for studying the formation of MCC and syn-tectonic granites. In the northern Cyclades, the Mykonos-Delos-Rhenia MCC is characterised by the intrusion of a plurikilometric Late Miocene pluton of I-type granite within a migmatitic gneiss dome. AMS (Anisotropy of magnetic susceptibility) and microstructural studies in the Mykonos granites combined with recent cooling rate data allow us to use the granites as strain marker.

The Mykonos granitoïds form a plurikilometric laccolith slightly deeping to the east and presenting an elliptical shape with a N170°E long axis. The laccolith is strongly asymmetrical with an outlying root zone in the SW cropping out on Delos and Rhenia islands and a major body mainly developed to the NE and cropping out on Mykonos Island. The laccolith consists of various petrographic facies presenting straight contacts that demonstrate emplacement by successive pulses of more or less differentiated magmas. The laccolith was developed at the interface between the Cycladic Basement and the Blueschists Unit and within the Blueschist Unit. Two events of deformation have been recorded in the granites. The first event is characterized by submagmatic and high to middle temperature protomylonite microstructures developped during or just after the intrusion. The second event of deformation characterized by low temperature mylonites and cataclasites close to the major detachment fault corresponds to the localization of deformation at the top of the laccolith after cooling due to heat exchange with country rocks and exhumation of the Mykonos MCC. The study of fabric evolution in the laccolith suggests that the laccolith structuration results from the interaction between regional deformation and lateral extension of magmas. Fabrics are indeed strongly planar close to the detachment, show an evolution toward plano-linear close to the bottom of the laccolith and are strongly linear in the root zone. Structural data suggest an evolution of the Mykonos MCC in three stages as follows: (i) a first stage characterized by the formation of a migmatitic "a-type dome" with a major axis parallel to the lineation such as Naxos dome by competition between regional N20 extension and EW shortening; (ii) a second stage marked by the emplacement of the Mykonos laccolith at 13 Ma at the top of the migmatitic paragneiss in the Blueschist Unit (iii) a progressive localisation of the deformation occured at the top of the laccolith in semi-ductile conditions on a thickness at about 500 m and thus in brittle conditions in the major detachment plane.

Our study shows that intensity of submagmatic to high temperature deformation observed in the laccolith remains low compared to the deformation observed in country-rocks. This suggests that intrusion of a laccolith in the roof of a MCC in partially molten rocks does not localize the deformation. By contrast the geometry of the intrusion shows that the magmas are sucked into the direction of regional extension and that the intrusion of magmas will inevitably cause a local acceleration of the MCC development. Finally, during its cooling the laccolith will localize the brittle ductile transition in its roof and caused the formation of a strong deformation zone first ductile and then brittle.