

## **Review of the Ph.D. thesis**

### **“Metamorphism and geotectonic position of the Shotur Kuh complex, central Iranian block”**

**by Mahmoud Rahmati Ilkhchi**

#### **General opinion:**

This thesis presents the results of petrological and structural investigations of the Shotur Kuh complex in the northeastern part of Iran. The thesis work consists of 4 parts, starting with summary of geology and metamorphism in Iran and 2 papers, each being a publication (International Journal of Earth Sciences, accepted) or submitted (?)

General conclusions summarise the major results.

It is a compact work combining modern petrological and structural methods based on previous geological mapping. Petrological aspects are based on microprobe analysis of major minerals in orthogneisses, metabasites and metapelites. Standard geothermobarometry and phase equilibria modeling allowed to determine the P-T conditions of metamorphism. Whole-rock chemistry is used to constrain the protoliths of investigated orthogneisses and amphibolites. Structural interpretation is based on field observations and the internal rock fabric and deformation. Geochronological data on zircon constrained the age of magmatic protolith of orthogneiss whereas Ar-Ar and K-Ar dating was used to constrain the postmetamorphic exhumation and cooling. The above methods allowed to recognise the Neoproterozoic granitoid magmatism and Jurassic metamorphism with possible 2 or 3 metamorphic events. This certainly contributes to a knowledge on geodynamic evolution of central Iran and interregional correlations.

I see no fundamental weaknesses of this work and believe that submitted paper will be accepted for publication. The interpretation of microtextures, geothermobarometric data

and modelled pseudosections is reliable and the conclusions are plausible. I am not an expert on regional geology of the area; however the interpretation and conclusions appear rational.

### **Specific comments:**

Chapter 1: I have had some difficulties to find a location of the investigated area, i.e. Shotur Kuh complex. It should be shown on map (Fig. 4).

Chapter 2 (paper accepted in International Journal of Earth Sciences),

- analytical methods: Nothing is written about the K-Ar dating and only a little about the Ar-Ar method.
- Fig.2: explanations are mixed up ( $d=b$ ,  $b=c$  and  $c=d$ ), also in text on page 44
- Page 44: „Phengite was found in kyanite, which together with partial replacement of amphibole by chlorite along the cleavage indicates very weak retrogression“ . Why? Makes no sense to me.
- PT conditions of metamorphism: Wu and Cheng (2006) recommended the thermometer of Perchuk and Lavrent'eva (1983) based on ideal mixing model of Fe and Mg, and calibrated to natural garnets, among four most reliable calibrations. In contrast, thermometer of Ganguly and Saxena (1984) was not recommended due to an error in the garnet activity model. Why did you use the Ganguly-Saxena and not Perchuk-Lavrent'eva calibration?
- Pseudosection in Fig. 9: Why did you use water (H<sub>2</sub>O) as thermodynamic component and melting was modeled and how did you determine the H<sub>2</sub>O = 1.0 content? Is melting observed in the investigated gneiss?
- Page 56: How did you calculate the temperature in the micaschist (P200) if pressure was not estimated? But you say that temperature was lower at the same pressure as in orthogneiss.
- Table 4, p.58, Results of Ar-Ar dating are missing in contrast to U-Pb and K-Ar data. This makes difficult to control the Ar-Ar results which are shown on Fig.11. But this is a question to co-author.

### Chapter 3 (paper in ???)

- PT conditions of metamorphism: 2 garnet populations. Is there only one garnet porphyroblast with distinct compositional patterns (Grt I, GrtII) or also 2 distinct garnet porphyroblasts, one Grt I and second Grt II ? It is confusing to say Grt I rim and Grt II core if there is just garnet overgrowth.
- Choice of Grt-Bi thermometers (the same as in paper 1)?
- Fig.12: P-T path of presumed contact metamorphism, why increasing P with T?

### **Conclusion**

I suggest to the scientific committee to accept this thesis work and award the Ph.D. degree to Mahmoud Rahmati Ilkhchi.

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