VERTICAL EVOLUTION OF THE ALBANIDES: FIRST RESULTS OF A FISSION-TRACKS THERMOCHRONOLOGICAL STUDY

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Abstract

Fission track analysis provides detailed information on the low-temperature thermal histories of rocks. Here we apply fission track analysis to characterize the recent evolution of the Albanian orogenic belt and its long-term denudation.

Keywords: Albania, vertical evolution, fission tracks thermochronology

Introduction

The Albanides show a rather complex structural evolution) (1, 2). To the West and North, tectonic units belonging to the Apulian paleo-margin were progressively emplaced in a subduction geodynamic environment and characterize a in-sequence thrust sytem. Thrusting was active during Eocene time in the internal part of the structure, and affected the more external zones during Pliocene times. Eastern and Central Albania show oceanic units (ophiolitic Mirdita nappe) and their tectonic substratum (Korabi and Rubik nappes). Emplacement of the ophiolitic nappe (obduction) on the Korabi has been dated between 162 and 174 My, both using stratigraphic and geo-chronologic methods (Ar/Ar on the metamorphic sole of the ophiolitic nappe) (1, 3). The tectonic pile (Mirdita/Korabi) has been itself thrusted onto the Apulian nappes during Tertiary times. The whole structural prism has been later faulted and fractured. Different large structure were emplaced like the NNW-SSE oriented Albano-Thessalian depression, which represents a neogene intra-mountainous basin, and the two major NE-SW striking fracture sets of Scutari-Pec and Vlora-Berati. However there is a general lacking of precise data allowing to a correct kinematic quantification of the recent geodynamic evolution of the Albanides. That's why we have perfor-med a thermo-chronologic program (NATO supported program) using Apatite and Zircon fission-tracks. This method allows to obtain geochronologic data on temperature intervals between 240/270°C (Zircon) and 60/120°C (Apatite) (4).

Methodology

Three sampling expeditions have been performed, and allowed to recuperate a total of 92 samples of about 70 localities from different tectonic units of the Albanides. The samples were crushed, and minerals were separated using Frantz separator and dense liquors in order to obtain Apatite and Zircon in the 80-160 µm granulometric fraction. Finally Apatite and Zircon were separated optically, sticked on a thin glass lamellae, polished, and submited to chemical attack in order to reveal the natural fission-tracks. After counting and measuring of the natural tracks, an external detector (mica) was sticked on the preparation, and the sample became irradiated in the Orphée reactor at Saclay. Induced fission tracks became counted and measured on the external detector after revelation.

Results

The first new data arise from samples of the internal units of Albania. In the Gashi zone, the Trokuzi granitoïd gives an Apatite age of 39.1 ± 4.4 My and a Zircon age of 108 ± 6 My. In the Mirdita zone a granitoïd intrusion (Fierza granitoïd) of the Rubik nappe gives an Apatite age of 52 ± 2.6 My. In the Korabi (Pelagonian) zone, 4 samples of monzonite and lamprophyre, intrusive in the Paleozoic basement , provide a very coherent Apatite age, near 11.5 My (11.6 ± 0.5 ; 12.4 ± 0.6 ; 11.2 ± 0.7 ; 11.4 ± 1.3), and a Zircon age of 126 ± 6.5 My.

The results of the Trokuzi granitoïd are in good agreement with the Late Eocene age for thrusting of the Gashi (Durmitor) nappe. Those for the Fierza granitoïd indicate that the substratum of the ophiolitic nappe (Rubik unit) remained buried at depth of about 4 km until 50 My, and exhumed since that time. In Albania the ophiolites have been submited to erosional process immediately after their thrusting in Middle Jurassic time, as shown by the intense lateritisation suffered in Late Jurassic times. Our results suggest that the thickness of the ophiolitic nappe remained still close to 4 km at 50 My at Fierza. This is compatible with the actually observed thickness of the ophiolitic nappe, which reach 4 km and 12 km respectively in the Bulqiza and the Tropoya massivs.

Modelisation

A thermal modelisation using the AFTsolve software (5) have been performed using the results of the Korabi zone, and suggest the following thermal behaviour: tracks began to be registered (T~110-120°C), corresponding to a depth of the order of 4 km, at about 16 to 15 My; the rocks then suffered a long period of constant low rate cooling (T~85-75°C), corresponding to a depth of the order of 3 to 2.5 Km, which ended at about 2.5-1.5 My, and more recently (T~15-0°C), cooling became faster suggesting a high rate of denudation and rapid uplift in an extensional tectonic regime.

References

1 - ISPJ-IGJN, 1983. Harta Gjeologijke e RPSSH, 1/200.000, Tirana.

2 - Meço S. and Aliaj S., 2000. Geology of Albania. *Beiträge Reg. Geol. Erde*, 28, 246 p., Geb. Borntraeger Ed., Berlin.

3 - Vergely P., Dimo A et Monié P., 1998. Datation des semelles métamorphiques ophiolitiques d'Albanie par la méthode $^{40}Ar/^{39}Ar$: conséquences sur le mécanisme de leur mise en place. *C.R. Ac. Sc. Paris*, 326 : 717-722.

4 - Gallagher K, Brown R and Johnson C., 1998. Fission track analysis and its applications to geological problems. *Ann. Rev. Earth Planet Sci*, 26 : 519-572.

5 - Galbraith R.F, Laslett G.M., Green P.F. and Duddy I.R., 1990. Apatite fission track analysis ; geological thermal history based on a three-dimensional random process of linear radiation damage. *Proc. R. Soc. London*, A, 332 : 419-438.