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DATING OF YOUNG TECTONIC MOVEMENTS AND DISTRIBUTION OF URANIUM IN APATITE OF GRANITOID AND METAMORPHOSED CRYSTALLINE ROCKS OF THE WEST CARPATHIANS

Study of apatite, which is one of the mostly wide-spread accessory minerals in granitoid and metamorphosed rocks of the West Carpathians has been aimed since the year 1975 at two main tasks:

a) to find out whether variability of uranium concentrations in accessory apatite at the level of individual grains can be used as petrogenetic indicator,

b) dating of apatite or other minerals by FT method, making possible reconstruction of young tectonic movements of crystalline massifs in the West Carpathians.

Concentration of uranium in apatites, as well as dating was determined by FT method (R. L. Fleischer et al., 1975). The method made possible the study of two different processes:

— distribution of uranium among individual apatite grains, a process connected with genesis of this mineral or rock,

— thermic history of rock at the temperatures about 100—120 °C, which reflects cooling of rock, caused by tectonic uplifting and denudation of overlying rocks.

Results of work:

1. Variability of uranium concentrations among individual grains of samples expressed by variation coefficient varies from 0.3 to 0.9 values (J. Kráľ, 1981). Variability range is practically identical for granitoid rocks and paragneisses. Apatites from migmatites of the Low Tatra have a trend to higher values of variability (over 0.5). For comparison, apatites from chemically close volcanic rocks are typical for low values of this coefficient (0.3—0.4).

The shapes of distribution curves were tested by χ^2 test against zero normal or lognormal hypothesis. For the majority of samples the model of lognormal distribution of uranium may be accepted, but in some samples the model of normal distribution of uranium can be preferred. In some cases empiric distributions do not conform to any tested model distribution. The different shapes of distribution curves cause that such a measure as e. g. average concentration of uranium in grains of one sample (from 7 to 67 ppm U) becomes absolutely artificial and conventional.

It may be supposed from the obtained shapes of distribution curves that empirical distribution are the so called joint distributions and the result of changes of parameters as, for instance, the continuous change of weights of distributions formed in different stages of crystallization, the change of chemical composition of melt, changes of distribution coefficient, changes of temperature, etc. Therefore the coefficient of uranium variation in apatite of

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granitoid rocks may be considered, together with distribution curves, for a semiquantitative indicator of crystallization rate (rate of cooling) and magnitude of the temperature interval in crystallization. Skewness of distribution curves is probably dependent on relative representation of apatite crystallizing in subsequent stages of crystallization. The construction of corresponding quantitative model of certain types of distribution curves is so far not possible, because the dependence of change of uranium distribution coefficient for apatite/melt on temperature change is not known.

2. Apatite from granitoid rocks is a mineral very suitable for dating of young tectonic history, as in this mineral the fossil tracks after fission of ^{238}U are preserved at the temperature 100—120 °C.

FT ages (fission track ages) of apatite obtained from granitoid rocks of the West Carpathians (J. K r á ľ, 1977) display regional zoning and dependence of age on a tectonic unit:

a) the ages of apatite in all core mountains besides the Low Tatra vary from 10 to 22 m. y. and they are Miocene ones,

b) apatite samples from the Low Tatra form a particular group of samples transitional in age, in which the ages vary from 28 to 53 m. y. (Oligocene — Eocene),

c) in comparison with the preceding two groups apatite samples from the Veporide crystalline complex are explicitly oldest, their FT age is about 75 m. y. (Upper Cretaceous).

The ages obtained and their zoning in north-south direction point at an asymmetrical uplifting — the most external parts of the Carpathian arc were uplifted much later than the central Veporide part.

The ages of zircon from granitoid rocks of some core mountains (Tribeč, Považský Inovec, Čierna hora) are higher than apatite ages. The differences in ages 33 to 57 m. y. are the result of different thermic history of the massifs at a temperature about 200 °C.

The agreement of apatite ages with well-known paleogeographical knowledge confirms that FT dating in crystalline rocks of the West Carpathians can be applied in reconstruction of paleography of the region.

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