RESEARCH NOTES

Fission Track Dating and Uranium Estimation of some Micaceous Minerals of Paddar Valley, Kishtwar (J and K State, India)

S. L. KOUL AND H. S. VIRK
Department of Physics, Panjabi University, Patiala

Abstract

Fission track ages of 10 samples of muscovite and biotite collected from different areas of Paddar Valley, Kishtwar (J and K State, India) have been determined. The mean ages obtained for this region for muscovite and biotite are 6.9 ± 1.4 and 38.2 ± 4.2 m.y. respectively. The micaceous minerals have been found to contain low concentration of Uranium $\sim 10^{-10}$ atom/atom. The f.t. ages correspond to the Tertiary era of the great Himalayan range and agree very well with the f.t. ages determined for the Himalayan orogeny.

Introduction

Fission track technique is the most simple, versatile and latest technique for geological dating as compared with other radiometric methods. It is based upon spontaneous fission of uranium impurity in minerals and rocks. This technique was introduced by Price and Walker (1963) and developed by Fleischer *et al* (1964). It is extensively being used for dating terrestrial and extra-terrestrial minerals and glasses.

The mountain range in which lies the Paddar Valley is an extension of the great Himalayan range. There is scanty data available regarding the geochronology of the vast Himalayan range.

Experimental procedure

To get a fairly good number of induced fission tracks, the samples were got irradiated in the thermal column of CIRUS Reactor of the Bhabha Atomic Research Centre, Trombay, with a total neutron dose (nvt) of 1.4×10^{18} neutrons/cm^2. The dose has been measured by a calibrated glass dosimeter (supplied through the courtesy of Dr. R. L. Fleischer) which was irradiated along with the samples.

The biotite samples showed non-uniform distribution of uranium and the irradiated samples were dotted with solarburst like events. Such samples were rejected for counting. Also, the density of induced fission tracks in biotite samples has been found to be higher than in the case of muscovite samples.

Discussion of Results

Our results are based on the study of 10 samples of muscovite and biotite collected from different areas of Paddar Valley. The mean f.t. ages for muscovite and biotite samples are 6.9 ± 1.4 and 38.2 ± 4.2 m.y. respectively. The uranium concentration in both the micaceous minerals is quite low $\sim 10^{-10}$ atom/atom. Experimental results are summarised in Table I.

The present study reveals the usefulness of fission track technique for young regions like the Himalayas. It is concluded that the ages of micaceous minerals of Paddar Valley can be considered to be associated with the last orogenic metamorphic

event in the history of the Himalayan rocks. Even the uranium distribution in the samples has been found to be identical in both cases viz. 10^{-10} atom/atom.

TABLE I

FISSION TRACK AGES OF MICACEOUS MINERALS OF PADDAR VALLEY, KISHTWAR (J AND K STATE, INDIA)

S. No.	Lab. Symbol.	(Cm^{Ps-2})	(Cm^{Pi-2})	Total neutron dose (nvt)	U. conc. atom/atom $\times 10^{-10}$	Fission track (age m.y.)	Mean age (m.y.)	Age by other groups
1	MPK- I	6	61532		1.4	7.8±1.6		
2	MPK- II	4	51129		1.1	6.5±1.3		
3	MPK-III	4	51826		1.2	5.7±1.2	6.9±1.4	
4	MPK-IV	5	57227		1.3	7.5±1.5		
5	MPK- V	6	69308		1.6	7.2±1.4		Nagpaul, Gupta & Mehta 4.7—36.0 m.y. (Siwalik system)
6	BPK - I	81	159998	1.4×10^{18}	4.1	38.0±4.2		
7	BPK - II	91	160932		4.1	44.4±4.7		
8	BPK -III	90	195651		5.0	32.0±3.5	38.2±4.2	
9	BPK -IV	85	170777		4.3	32.0±3.7		
10	BPK - V	90	156190		4.0	44.4±4.8		

An important factor which influences the f.t. age of the mineral is the annealing characteristics of radiation damage (fossil) tracks. Radiation damage tends to heal at high temperatures obtainable during a major thermal event associated with orogenic metamorphic cycles which rejuvenate all minerals and re-set their geochronological clock. The annealing correction has not been applied to our f.t. age results due to very low density of fossil tracks. The errors shown in the results are purely statistical counting errors.

Acknowledgement: The work has been supported by C.S.I.R., India. The authors are grateful to Shri S. M. Hassan, Officer on Special Duty, Department of Geology and Mining, Shri L. K. Bhat, Geologist, Shri R. L. Bangroo, Assistant Geologist and Shri Brij Mohan Tickoo, for the supply of samples. They are also thankful to Shri Surinder Singh for help.

References

FLEISCHER, R. L. and PRICE, P. B., (1964) Technique for geological dating of minerals by chemical etching of fission fragment tracks: *Geochim. Cosmochim. Acta*, v. 28, pp. 1705-1714.

NAGPAUL, K. K., GUPTA, M. L. and MEHTA, P. P., (1973) Fission track ages of some Himalayan granites: *Himalayan Geology*, v. 3, pp. 249-261.

PRICE, P. B. and WALKER, R. M., (1963) Fossil tracks of charged particles in mica and age of minerals. *Jour. Geophys. Res.*, v. 68, p. 4847-4862.