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**FISSION TRACK DATING OF ZIRCON FROM 11850-11870 FEET,
AROO-1, BASS BASIN.**

A report prepared for the Amoco Australia Petroleum Company

by P.F. Green and I.R. Duddy

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SAMPLES AND SUITABILITY

Two samples were originally submitted in order to determine the suitability for determination of the age of a basalt intersection in Aroo-1. The core chip from 11783' was unsuitable for analysis. The cuttings sample from 11850-860 feet was processed and was found to be promising for fission track dating with recovery of a small quantity of both zircon and apatite. This sample was subsequently supplemented by a sample of cuttings from the contact zone with the basalt over the interval 11850-11870' from the BMR collection which also yielded small quantities of zircon and apatite.

Considering the depth and present day temperature of the basalt interval it was decided that zircon would be the most appropriate mineral for dating. The zircon separates from the individual cuttings samples were combined into a single sample (8522-25).

TECHNIQUES

Fission track age and length measurements were made using techniques outlined by Gleadow *et al.* (1983). Zircons were embedded in FEP teflon, polished and etched for approx 30 hours in a molten eutectic of NaOH and KOH at approximately 210°C to reveal the fossil fission tracks. The zircon mounts were processed by the external detector method (Gleadow, 1981) which, apart from its greater inherent precision, has the advantage of allowing single grain ages to be determined. Tracks were counted over all available grains in this mount although a larger number is usually preferred.

Ages were calculated using the standard fission track age equation (Hurford and Green, 1982) and errors are quoted at the level of one standard deviation throughout. Errors were calculated using the techniques outlined by Green (1981) based on the total number of tracks counted for each track density measurement. All constants used in derivation of the results are shown at the bottom of Table 1 using the nomenclature of Hurford and Green (1982). The Zeta calibration factor has been determined empirically by direct comparison with K-Ar ages for a set of carefully chosen age standards.

Neutron irradiations were carried out in a well thermalised flux (X-7 facility) in the Australian Atomic Energy Commission's HIFAR research reactor. Total neutron fluence was monitored by counting tracks in mica external detectors attached to two pieces of the NBS standard glass SRM612 included in the irradiation cannister at each end of the sample stack. No flux gradient is usually found in the irradiation facility used over the length of the sample package and this was confirmed by the track counts over the two dosimeter glasses.

RESULTS

Full analytical data for the fission track age is given in Table 1. Single grain ages are given with the primary counting results and statistical data in the Table 1. Variation in the apparent ages of single zircon grains is illustrated by a histogram and a smoothed probability distribution for each sample in Figure 1.

Two statistical parameters are also given in Table 1, which are used to test the variability of apparent ages between single apatite grains. The correlation coefficient indicates the degree of correlation between the fossil and induced track densities for all the grains counted. For a population of apatites having a uniform age and a significant spread in uranium concentration, the correlation coefficient should be close to 1. However, if the uranium concentration is relatively uniform, a low correlation coefficient may be obtained even where the apatite fission track ages are identical. A more useful parameter is the Chi squared statistic which indicates the probability that all the grains counted belong to a single age population. A probability of less than 5% is taken as evidence that the grains represent a mixed age population with real differences between the apparent ages of individual grains. A spread in grain ages can result either from inheritance of detrital grains from mixed source areas, or from partial annealing by heating to above approx. 200°C in the case of zircon. Such temperatures would be confined to the immediate contact zone with the basalt.

It can be seen in Table 1 that the sample fails the Chi squared test at the 95% confidence level and has a low correlation coefficient. In this case, where we are clearly dealing with a mixed detrital population with the possibility of a thermal overprint due to basalt extrusion neither of the usual measurements of combined fission track age, the pooled age and mean age, is meaningful.

The age of the twelve grains varies from a reasonably precise 77.5 ± 8.3 Myr to 437 ± 73 Myr and clearly cannot be considered as belonging to a single population. Thus the youngest grain age of 77.3 ± 8.3 Myr can be taken as the maximum age of the basalt interval sampled. Other single grain ages given in Table 1 may either represent true source ages of the detritus or partial ages resulting from incomplete track erasure at lower temperatures more distant from the site of extrusion.

REFERENCES

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Hurford A.J. and Green P.F. 1982, A user's guide to fission track dating calibration. Ear. Plan. Sci Lett. 59, 343-354.

Table 1: Full analytical data for zircon, Aroo-1 (11850-11860').

8522-25 ZIRCON AROO-1

IRRADIATION: PT705-1
ANALYSIS BY PFG

CRYSTAL	NS	NI	AREA UNITS	RATIO	RHO S	RHO I	AGE(MYR)
1	117	33	6	3.545	2.26E+07	6.38E+06	182.2 +- 35.9
2	451	92	30	4.902	1.74E+07	3.56E+06	250.6 +- 28.7
3	185	35	9	3.000	1.35E+07	4.51E+06	154.5 +- 30.2
4	133	44	16	3.023	9.64E+06	3.19E+06	155.7 +- 27.1
5	161	40	20	4.025	9.33E+06	2.32E+06	206.5 +- 36.5
6	138	20	12	6.900	1.33E+07	1.93E+06	350.0 +- 83.7
7	56	17	5	3.294	1.30E+07	3.94E+06	169.5 +- 46.9
8	217	145	40	1.497	6.29E+06	4.20E+06	77.5 +- 8.3
9	144	25	14	5.760	1.19E+07	2.07E+06	293.5 +- 63.6
10	146	35	9	4.171	1.80E+07	4.51E+06	213.8 +- 40.2
11	347	40	20	8.675	2.01E+07	2.32E+06	437.0 +- 73.0
12	82	27	15	3.037	6.34E+06	2.09E+06	156.4 +- 34.7
	<u>2097</u>	<u>553</u>			<u>1.240E+07</u>	<u>3.271E+06</u>	

AREA OF BASIC UNIT = 8.626E-07 CM²

VARIANCE OF SQR(NS) = 15.0311

VARIANCE OF SQR(NI) = 5.02443

CORRELATION COEFFICIENT = 0.536

CHI SQUARED = 126.899 WITH 11 DEGREES OF FREEDOM FAIL

NS/NI = 3.792 +- 0.181

MEAN RATIO = 4.319 +- 0.570

AGE CALCULATED USING A ZETA OF 87.9 FOR U3 GLASS

RHO D = 1.186E+06 ND = 2598

POOLED AGE = 194.7 +- 10.1 MYR

MEAN AGE = 221.3 +- 29.5 MYR

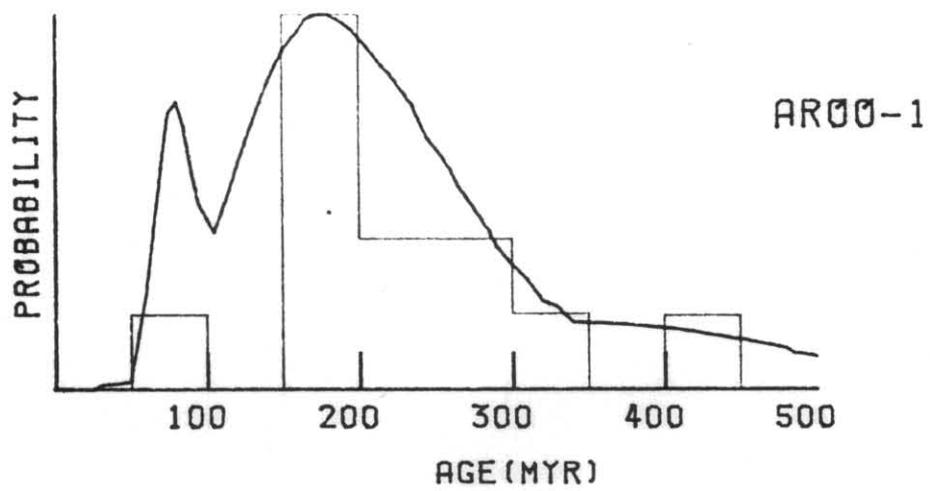


Figure 1: Histogram of single grain ages and smoothed probability distribution.

