ZIRCON FISSION-TRACK AGES FOR THE OLYMPIC SUBDUCTION COMPLEX AND ADJACENT EOCENE BASINS, WESTERN WASHINGTON STATE

by

MARK T. BRANDON
Department of Geology and Geophysics
Yale University
P.O. Box 6666
New Haven, CT 06511

and

JOSEPH A. VANCE
Department of Geological Sciences, AJ-20
University of Washington
Seattle, WA 98195

WASHINGTON DIVISION OF GEOLOGY AND EARTH RESOURCES

OPEN FILE REPORT 92-6

August 1992

This report has not been edited or reviewed for conformity with Division of Geology and Earth Resources standards or geologic nomenclature.

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Brian Boyle - Commissioner of Public Lands
Art Stearns - Supervisor

Division of Geology and Earth Resources
Raymond Lasmanis, State Geologist

CONTENTS

Page

Introduction 1
Laboratory procedures 2
Decomposition of FT grain-age distributions 4
FT results 7
  Youngest populations in the unreset samples 7
  Reset OSC samples 13
Geologic implications 14
References cited 14
Appendix A 16
Appendix B 18

ILLUSTRATIONS

Figure 1. Regional map showing location of study areas 2
Figure 2. Best-fit Gaussian peaks for a composite density plot (Mount Tom) 6
Figure 3. Summary map of zircon FT ages from the Olympic subduction complex 12

TABLES

Table 1. Grain ages for Mount Tom 5
Table 2. Zircon FT results for Eocene basins samples and other miscellaneous samples 8
Table 3. Zircon FT results for the western group of unreset samples from the Olympic subduction complex . . . 9
Table 4. Zircon FT results for the eastern group of unreset samples from the Olympic subduction complex . . . 10
Table 5. Zircon FT results for reset samples from the Olympic subduction complex 11

Zircon Fission-Track Ages for the Olympic Subduction Complex and Adjacent Eocene Basins, Western Washington State

by
Mark T. Brandon
Department of Geology and Geophysics
Yale University
P.O. Box 6666
New Haven, CT 06511
and
Joseph A. Vance
Department of Geological Sciences, AJ-20
University of Washington
Seattle, WA 98195

INTRODUCTION

The Olympic subduction complex (OSC), exposed in the Olympic Mountains of northwest Washington State (Fig. 1), consists of an imbricated assemblage of Cenozoic sandstone, mudstone, and minor pillow basalt (Tabor and Cady, 1978a, b). The tectonic evolution of the OSC has been difficult to resolve because of poor age control, especially for the more easterly parts of the complex. Brandon and Vance (1992) have used the fission track (FT) method to date detrital zircons from sandstones of the OSC with the objective to better define the timing of deposition, subduction accretion, and metamorphism. The external detector method was used to determine grain ages for individual detrital zircons. For unreset samples, the detrital zircons still retain pre-depositional FT ages, which are related to the thermal history of the source region from which the zircons were derived. For the zircons to remain unreset, the sediment had to stay at temperatures less than about 175° to 185°C (Brandon and Vance, 1992). In this case, determination of the FT age of the youngest population of grain ages is especially useful because it provides a maximum age for deposition of the sediment. For reset samples, the dated sediments must have been heated to temperatures in excess of about 240° to 245°C in order to completely anneal fission tracks in the detrital zircons (Brandon and Vance, 1992). Grain ages from these samples show a restricted range of ages which can be used to define post-metamorphic cooling ages.

The main purpose of this open-file report is to provide a record of the original grain age data and FT measurements used by Brandon and Vance (1992) (see Appendix B). A brief overview and summary of results are also included. Brandon and Vance (1992) determined a total of 928 grain ages in 19 sandstone samples. Of the 15 samples from the OSC, 11 are unreset and retain detrital FT ages, and 4 are reset and provide information about the cooling history of the OSC. For purposes of comparison, Brandon and Vance (1992) included 4 additional unreset sandstone samples and 1 volcanic tuff from unmetamorphosed Eocene strata to the east and southeast of the Olympics (C1 through C5 in Fig. 1). These samples were used to estimate the lag time between the age of the youngest fraction of FT grain ages and the depositional age of the rock.

The statistical methods outlined in Brandon (1992) were used to interpret each of the unreset grain-age distributions. The χ^2 age method estimates the FT age of the youngest population of "plausibly related" grains, defined as the χ^2 age. The peak-fitting method is used to decompose an entire grain-age distribution into a set of component grain-age populations, each of which is distinguished by a peak age, defined as the average FT age of the component population. For the OSC sandstones, the youngest of the component population is of particular interest because it provides a maximum limit for the depositional age of the sample. The older component populations have also proven useful for resolving the provenance of the sandstones and as an indicator of partial resetting (Brandon and Vance, 1992). If the source region for the zircons was tectonically or magmatically active, as was the case for the Pacific Northwest during the Cenozoic, then the time lag between the FT age of the youngest zircons and deposition of the sandstone should be relatively short. Brandon and Vance (1992) estimated a lag time of less than <5 Myr, based on results from the Eocene basin samples (samples C1-C4). With such a short lag time, the FT age of the youngest zircons becomes a useful proxy for the depositional age of a dated sandstone sample.

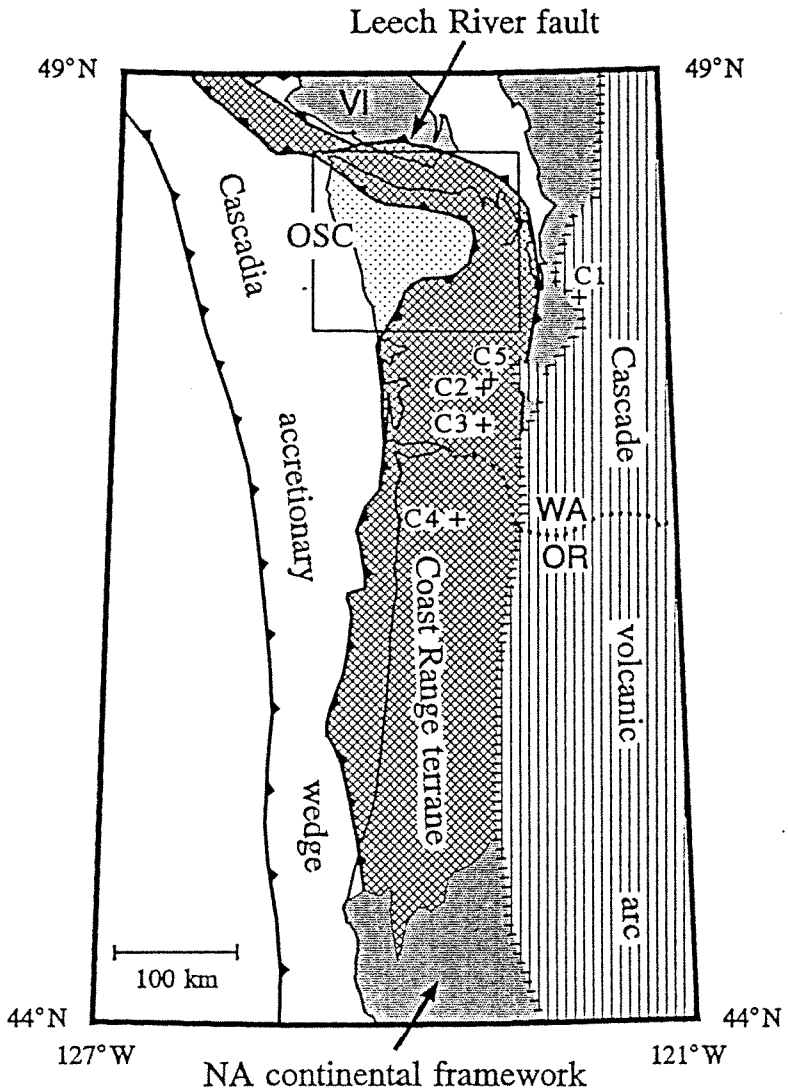

Figure 1. Geologic map showing the regional setting of the Olympic subduction complex (OSC). The North American continental framework is shown in a dark gray pattern. The Coast Range terrane, in a cross-hatched pattern. The Cascade volcanic arc and its basement are shown in a vertical ruled pattern. The Cascadia accretionary wedge has no pattern in the offshore area, and where it is exposed as the OSC in the Olympic Mountains, it is marked by a screened pattern. The box shows the location of the map in Figure 3. Locations of the Eocene basin samples (Table 2) are marked C1 through C5. Abbreviations: VI, Vancouver Island, WA, Washington, OR, Oregon.

LABORATORY PROCEDURES

About 2 to 12 kg of fine- to medium-grained sandstone were collected at each sample locality. Samples were crushed, washed, and sieved. Zircon was isolated using hydraulic separation, heavy liquids, and magnetic separation. Sieving and handpicking were used to isolate a final fraction of 400 to 800 grains in the 100 to 170 mesh-size range. The well formed euhedral grains were most commonly selected, but some rounded grains were also

intentionally included. The selected zircons were mounted in heat-softened teflon discs and then polished. The mount was then etched in a eutectic mixture of KOH and NaOH at 220°C for 6 to 12 hours, as necessary to obtain a high quality etch (Gleadow, 1981, p. 10). In many cases, samples were dated using two mounts per sample, each with different etch times in order to avoid biases between old and young grains (Naeser and others, 1987). Our experience, however, did not reveal any systematic age differences between paired mounts.

Reset samples usually required the greatest amount of etch time which suggests a lower density of α-radiation damage in those zircons (Gleadow, 1981). For zircon, the partial stability zones for α-radiation damage and for fission tracks appear to overlap, with fission tracks having slightly greater thermal stability than α-damage (Kasuya and Naeser, 1988; Tagami, Ito, and Nishimura, 1990). Thus, it is inferred that the thermal event responsible for annealing fission tracks in zircons from the reset samples also annealed the α-radiation damage.

The mounts were covered with a flake of low U muscovite and irradiated in a nuclear reactor, either at University of Washington (UW) (reactor decommissioned in 1988) or at Oregon State University (OSU). The measured cadmium ratios (relative to an Au monitor) at the irradiation positions used in these reactors was ~100 for the UW reactor and 14 for the OSU reactor, indicating that the neutron fluence was well thermalized. Green and Hurford (1984) argue that for FT dating, the cadmium ratio relative to an Au monitor should be significantly greater than 3.

The neutron fluence was determined by reference to the track density produced in a muscovite flake mounted on either a glass standard of known U content (SRM 962; Carpenter and Reimer, 1974) or zircons of a known age (Fish Canyon tuff; Hurford and Green, 1983, p. 299). Glass standards were used in 5 out of the 7 irradiations. In all cases, the fluence monitors were placed at both ends of the irradiation package to determine fluence gradients. Mounts of Fish Canyon zircon were included as secondary standards in all packages that used a fluence monitor with a glass standard.

All tracks were counted using the same microscope setup (Zeiss microscope, 1250x magnification using oil). Systematic traverses were made, and all suitable grains were counted. Care was take to count only properly etched grains where the section was parallel to the c crystallographic axis, polishing scratches were sharply defined, and all tracks were clearly resolved. An effort was made to count grains with both low and high track densities to avoid systematic biases between young and old grains.

Ages were calculated using standard formulas and constants (Hurford and Green, 1983, p. 285-286), with the exception of the ^{238}U spontaneous fission decay constant for which a value of 7.03×10^{-17} yr^{-1} (Roberts, Gold, and Armani, 1968; Naeser, Naeser, and McCulloh, 1989, p. 166) was adopted. The internally calibrated zeta method is superior to the externally calibrated method used here (Hurford and Green, 1983). Nonetheless, the secondary standards show that our ages are not systematically biased. The mean age of 72 grains of Fish Canyon zircon from internal standards used in 6 irradiations is 28.6 ± 1.9 Ma (F1 in Table 2; note that one internal standard is from another study), which compares favorably with the accepted K-Ar age of 27.9 Ma (Hurford and Green, 1983).

When assigning an age and uncertainty to a group of grain ages, there should be a reasonable assurance that the grain ages have experienced a common thermal history. The χ^2 test of Galbraith (1981) and Green (1981) provides one method for checking this assumption. A group of grain ages is judged to be completely reset when the distribution passes the χ^2 test at a probability $P(\chi^2) > 5$ percent (Galbraith, 1981; Green, 1981). This result indicates that there is a reasonable probability that Poisson variability in the radioactive decay process is the sole source of variability among the grain ages. In this case, a *pooled age* is calculated by combining track data for all dated grains (Green, 1981, equation 3). The assignment of an age is more difficult when the χ^2 test is failed ($P(\chi^2) < 5$ percent). The most common approach is to calculate a *mean age* directly from the grain ages (Green, 1981, equation 10). This approach is not suitable for mixed distributions of grain ages as might be found in an unreset or partially reset sandstone. In these cases, it is necessary to use decomposition methods, like the χ^2 age and Gaussian peak-fitting methods of Brandon (1992) or the peak fitting methods of Galbraith and Green (1990).

The estimated total uncertainty for a FT age includes two sources of error, called grain error and group error (Brandon, 1992). Grain error corresponds to the uncertainties associated with measuring the spontaneous and induced track densities in each of the grains. For a single grain age or for a pooled age, the grain error is estimated assuming Poisson errors for the measured spontaneous and induced track densities (Green, 1981; equation 4). For a mean age, the grain error is determined using the estimated standard error calculated from the grain age distribution (Green, 1981, equation 11; note typographical error in equation). Group error corresponds to those uncertainties that are common to all grains in the group, such as uncertainties associated with laboratory calibration constants or the measured track density in the mica detector of a fluence monitor. The total uncertainty of a cited FT age should

include both the grain and group errors (e.g., Green, 1981, equation 5). In this paper, unless otherwise noted, all uncertainties represent total uncertainties and are cited at two times the standard error (± 2s), approximately equal to a 95 percent confidence interval around the estimated age.

The uranium content of each grain was calculating using the method of Potts (1987, p. 448) and is reported in Appendix B. This information was used to see if there was any obvious correlation between grain age and U content for the unreset and reset grain age distributions; none was found. The U content of the grain is equal to the U content of the glass standard times the induced track density for the grain divided by the induced track density for the glass standard. The SRM 962 glass standard has an effective U content of 12.3 ppm (Green, 1985, p. 3; note that the SRM 612 glass is an older version of SRM 962). For fluence monitors using Fish Canyon zircons as a standard, the measured neutron fluence was used to calculate the induced track density expected for a mica detector against an SRM 962 glass standard.

DECOMPOSITION OF FT GRAIN-AGE DISTRIBUTIONS

A substantial challenge in FT dating of unreset detrital zircons is the interpretation of the resulting grain-age distributions. The grain ages themselves are not sufficiently precise to be used individually. For the study of Brandon and Vance (1992), the average total uncertainty (± 2s) for a FT age of a single zircon grain is about ±26 percent of the estimated age. Therefore, it is necessary to gather grain ages into related groups in order to improve the precision of the age estimates and also to reduce the grain-age data to a more meaningful and compact form.

One approach to this problem is to view a grain-age distribution as a mixture of several component grain-age populations, with each component derived from a specific *FT source terrain* (Brandon, 1992). A FT source terrain is defined as a discrete area in the general source region that yields zircons of a characteristic FT age. In reality, a given source region is probably capable of delivering a wide range of FT grain ages, but it is anticipated that a few dominant component populations will account for the bulk of the grain ages. In the study of Brandon and Vance (1992), component populations were identified using two methods from Brandon (1992).

The first method, called the χ^2 *age method*, is designed to isolate a group of young grain ages that with statistical confidence might plausibly have been derived from a single-age FT source terrain. This method is based on the χ^2 test of Galbraith (1981) and Green (1981). To calculate the χ^2 age of a grain-age distribution, the grain ages are first arranged in order of increasing age (see Table 1 for an example). Moving down the list, a *sum age* and $P(\chi^2)$, the probability for the χ^2 test, are calculated at each grain age. The sum age is the pooled age for all grain ages equal to or younger than the current grain age. The χ^2 test compares a distribution of grain ages with their sum age, which is the expected age of the grains if they were derived from a single-age source. $P(\chi^2)$ is the probability that deviations from the expected age might be due solely to Poisson variations associated with the process of radioactive decay. Brandon (1992) defined the χ^2 age as the pooled age of the largest group of young grains that still retains $P(\chi^2)$ greater than 1 percent. The critical probability of 1 percent is used to ensure that if any bias exists, that it will be towards a slightly older age. This choice is in keeping with the main use of the χ^2 age as a maximum limit for the depositional age of the sample. The advantage of the χ^2 age method is that it is relatively simple to calculate and carries the statistical assurance that the age is representative of the youngest fraction of "plausibly related" grain ages.

The second method, called the *Gaussian peak-fitting method*, decomposes the full grain-age distribution into a series of component grain-age populations, as illustrated in Figure 2. In statistics, this type of distribution is called a finite-mixture distribution (e.g., McLachlan and Basford, 1988). The Gaussian peak-fitting method utilizes the composite probability density plot of Hurford, Fitch, and Clarke (1984), which portrays the grain-age distribution as a continuous probability density plot. The basic assumption is that each of the component grain-age populations in the composite probability density plot can be represented by a unique Gaussian function, defined by a mean μ_{fj}, a relative standard deviation W_{fj}, and the number of grains N_{fj}, where j = 1, . . . , g, with g equal to the total number of component populations. Each of the component Gaussian distributions can be considered to correspond to specific peaks in the composite probability density plot. As used here, the term "peak" refers to any component Gaussian distribution, even those for which there is no visible peak in the composite probability density plot. This situation

Table 1. Grain ages for Mount Tom (ZD6)

No.	Grain age ± 2s (Ma)		$P(\chi^2)$ (%)	Sum age ± 2s (Ma)	
1	14.0	4.6	100.0	14.0	4.6
2	14.1	4.1	96.6	14.0	3.1
3	14.1	7.3	99.9	14.1	2.8
4	17.4	6.3	78.5	14.8	2.6
5	18.0	6.0	69.7	15.4	2.4
6	18.9	6.8	65.0	15.9	2.3
7	19.2	8.3	67.4	16.2	2.3
8	20.0	6.2	58.8	16.7	2.2
9	20.0	6.9	58.6	17.1	2.1
10	20.1	9.2	63.5	17.2	2.0
11	20.6	6.5	61.3	17.6	2.0
12	20.9	7.2	61.7	17.8	1.9
13	21.3	6.3	58.6	18.2	1.9
14	28.2	9.7	22.3	18.8	1.9
15	**31.8**	**16.3**	**11.1**	**19.1**	**1.9***
16	35.8	12.0	0.3	19.9	1.9
17	38.7	12.6	0.0	20.8	1.9
18	38.9	9.6	0.0	22.2	1.9
19	40.3	14.1	0.0	22.9	2.0
20	40.8	10.9	0.0	23.9	2.0
21	41.0	12.9	0.0	24.6	2.0
22	41.5	11.8	0.0	25.4	2.0
23	42.8	12.0	0.0	26.2	2.0
24	44.5	12.4	0.0	27.0	2.0
25	44.8	15.0	0.0	27.5	2.0
26	45.7	13.5	0.0	28.2	2.1
27	45.8	11.7	0.0	29.0	2.1
28	46.3	14.3	0.0	29.5	2.1
29	49.1	10.5	0.0	30.7	2.1
30	50.5	18.6	0.0	31.0	2.1
31	50.6	15.0	0.0	31.6	2.1
32	54.6	18.7	0.0	32.0	2.1
33	55.2	21.9	0.0	32.4	2.1
34	58.7	17.7	0.0	33.0	2.2
35	58.8	14.1	0.0	34.0	2.2
36	59.8	23.7	0.0	34.3	2.2
37	60.7	16.1	0.0	35.1	2.2
38	63.0	20.9	0.0	35.6	2.2
39	63.6	17.5	0.0	36.3	2.2
40	65.3	18.2	0.0	37.0	2.3
41	66.7	18.2	0.0	37.7	2.3
42	72.0	22.4	0.0	38.3	2.3
43	73.0	22.6	0.0	38.9	2.3
44	77.8	29.6	0.0	39.4	2.3
45	80.2	24.5	0.0	40.1	2.4
46	81.2	28.3	0.0	40.6	2.4
47	81.4	29.0	0.0	41.1	2.4
48	91.8	30.8	0.0	41.8	2.4
49	153.1	55.4	0.0	42.9	2.5
50	195.0	62.9	0.0	44.7	2.6
POOLED AGE				44.7	2.6
MEAN AGE				50.2	9.7

*χ^2 age = 19.1 ± 1.9 Ma

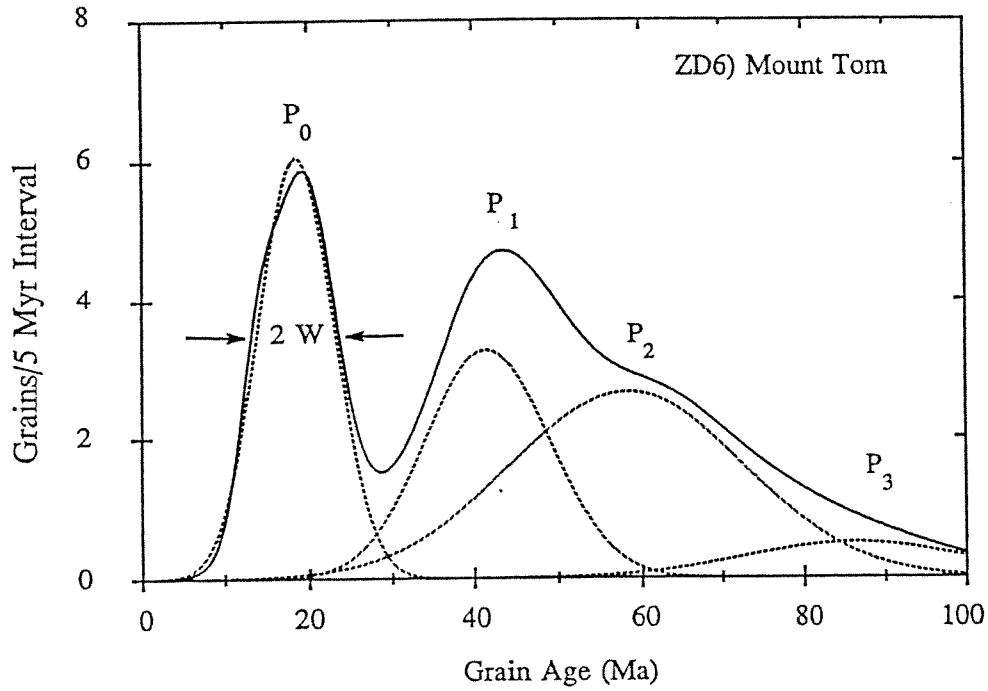

Figure 2. Best-fit Gaussian peaks for a composite probability density plot (sample ZD6 from Tables 1 and 3). The solid line corresponds to the composite probability density plot, and the dashed lines to the component Gaussian peaks. The peaks are labeled P_0 for the youngest peak, and P_1, P_2, and P_3 for the older peaks. The width of a peak is measured by its relative standard deviation, W, as illustrated by the label "2W".

can occur when two component populations are closely spaced in age so that their respective Gaussian distributions overlap.

The parameters for the component Gaussian functions are determined using a nonlinear least-squares program developed by Brandon (1992). The reader is referred there for specific details. That paper outlines a procedure and some criteria for judging the overall suitability of a best-fit solution. It also presents some test examples using simulated and real data that show how the method performs, what its limitations are, and how it compares with the binomial peak-fitting method of Galbraith and Green (1990).

The relative standard deviation, W_{fj}, is equal to σ_{fj}/μ_{fj}, where σ_{fj} is the absolute standard deviation of the jth Gaussian peak as represented in the composite probability density plot. Both W_{fj} and σ_{fj} provide a useful measure of the width of the peak, which, in turn, is related to the degree of variation among those grain ages that make up the peak. However, the relative standard deviation, W_{fj}, is preferred, because it does not vary significantly as a function of FT age. Analysis of zircons from volcanic rocks indicates that for a single-age source, W_{fj} should be about 16.3 percent (C5 and F1 in Table 2). The following general guidelines are used to interpret W_{fj}: When a best-fit peak has W_{fj} between 12 to 20 percent, this is taken as evidence that the peak corresponds to a component population derived from a single-age FT source. A peak with W_{fj} greater than about 20 percent has a high probability of being a composite peak, defined as a peak composed of two or more single-age populations. A peak with W_{fj} significant less than about 12 percent suggests that the underlying component population was incompletely sampled, which tends to occur when the number of grains in a peak, N_{fj}, is less than about 8 to 10 (i.e., downward bias of the estimated standard deviation due to a small sample size).

FT RESULTS

The 19 dated sandstone samples are divided into 4 groups. The first group consists of the unreset Eocene basin samples (Table 2, Fig. 1). The next 2 groups encompass the unreset OSC samples which are divided on the basis of location into a western group and an eastern group (Tables 3 and 4, Fig. 3). The last group consists of reset samples from the central part of the OSC (Table 5, Fig. 3). Sample locations and local geologic setting are described in the Appendix A. The original fission track data are reported in Appendix B.

The OSC samples were selected to include all of the major units of Tabor and Cady (1978a, b), except for the Miocene Hoh assemblage of the western OSC which was already well dated. Most OSC samples were collected along an east-west transect through the middle of the Olympic Mountains, with some supplementary samples to the north and south (Fig. 3). All of the OSC samples come from turbidite sequences, indicating marine deposition below storm wave base, presumably in a deep marine setting, such as a trench basin.

An important problem in interpreting the FT data is the distinction between unreset and reset samples. One crude indicator is the total range of FT grain ages in a sample distribution. On this basis, there appears to be a clear distinction between samples that have a wide distribution in grain ages which are designated as "unreset" (Tables 2-4; distribution widths from 54 to 361 Myr), and those that have a very narrow distribution which are designated as "reset" (Table 5; distribution widths from 13 to 27 Myr). One difficulty with this classification is that it ignores the possibility that the "unreset" samples might have been partially reset or the "reset" samples might not have been totally reset. These problems were closely examine in Brandon and Vance (1992). They concluded that the "unreset" samples have not been significantly affected by partial resetting (<10 percent reduction in age), and that the "reset" samples retain a significant fraction of incompletely reset grains.

The next several sections summarize average FT ages for the youngest fraction of grain from the unreset samples and cooling FT ages for the reset samples. The reader is referred to Brandon and Vance (1992) for a discussion of the older peaks in the unreset samples.

Youngest populations in the unreset samples

Eocene basin samples. Samples C1 to C4 (Table 2) were collected from Eocene basin sequences located to the east and southeast of the Olympics (Fig. 1). They were used to examine the relationship between depositional age and the FT age of the youngest grain-age population. The samples are friable arkosic sandstones and lack any indication of low grade metamorphism. All 4 samples come from reasonably well dated stratigraphic sections with depositional ages of Middle and Late Eocene (48 to 37.5 Ma; see Appendix B). There is generally good agreement between the χ^2 ages and youngest peak ages (Table 2). The widths of the youngest peaks are consistent with their derivation from a single-age FT source terrain, with the possible exception of C1. Expected depositional ages are listed in the first column of Table 2. A quick comparison shows that the χ^2 ages and the youngest peak ages provide reasonable approximations of the expected depositional ages.

These results support the interpretation that the FT age of the youngest grain-age population closely tracks the depositional age of the sandstone. Brandon and Vance (1992) estimated that the lag time is probably less than about 5 Myr. A short lag time is compatible with geologic evidence that indicates widespread igneous and tectonic activity in Washington, Idaho, Montana, and British Columbia throughout much of the Eocene (e.g., Armstrong and Ward, 1991). Tectonic activity diminished during the Oligocene and Miocene, but igneous activity in the Cascade volcanic arc, from Oligocene to present, probably provided another source of young zircons. This point is important because χ^2 ages for the unreset OSC samples range from Eocene to Miocene, with 6 out of 11 samples having ages significantly younger than the Eocene basin samples.

Western group of OSC samples. Of the 5 samples in this group (Table 3, Fig. 3), 3 come from well mapped parts of the Western Olympic assemblage of Tabor and Cady (1978b). The remaining 2 are from an undifferentiated unit (Tur of Tabor and Cady, 1978b), which may represent a western continuation of the Western Olympic assemblage (e.g., see figure 3 in Heller and others, 1992). There is generally close agreement between the χ^2 age and the youngest peak age, with the exception of sample ZD38 for which the χ^2 age is about 6 Myr older than the youngest peak age. The widths of the youngest peaks are consistent with their derivation from a single-age FT source terrain, with the possible exception of ZD6.

Table 2. Zircon FT results for Eocene basins samples and other miscellaneous samples

Lab#)	Geologic Unit, Location	Age Range, Number of Grains	Youngest Fraction: χ^2 Age	Youngest Fraction: Youngest Peak	Older Peaks (~43 Ma)	Older Peaks (~57 Ma)	Older Peaks (~74 Ma)	Oldest Fraction (> ~100 Ma)
Unreset sandstones from Eocene basins								
C1)	Upper part of Puget Group, Ravensdale, Washington (EA ≥ ~38.2 Ma)	24 - 259 Ma N_t = 50	39.4 ± 2.8 Ma N_f = 18	41.3 Ma* N_f = 19 W = 23%	41 Ma*	56 Ma N_f = 10 W = 19%	79 Ma N_f = 12 W = 24%	106 - 259 Ma N_f = 7
C2)	Skookumchuck Fm., S of Centralia, Washington (EA ~39.2 Ma)	32 - 143 Ma N_t = 60	44.7 ± 2.8 Ma N_f = 24	41.6 Ma* N_f = 11 W = 16%	42 Ma*	57 Ma N_f = 21 W = 21%	97 Ma N_f = 27 W = 33%	101 - 143 Ma N_f = 14
C3)	Stillwater Member of the Cowlitz Fm., N of Ryderwood, Washington (EA ~48 to 37.5 Ma)	35 - 248 Ma N_t = 60	51.3 ± 3.6 Ma N_f = 26	49.5 Ma* N_f = 17 W = 17%	50 Ma*	- n.d. -	75 Ma N_f = 35 W = 24%	100 - 248 Ma N_f = 8
C4)	Cowlitz Fm., W of Timber, Oregon (EA ~48 to 37.5 Ma)	28 - 169 Ma N_t = 60	43.6 ± 2.5 Ma N_f = 26	43.2 Ma* N_f = 21 W = 18%	43 Ma*	59 Ma N_f = 18 W = 16%	75 Ma N_f = 18 W = 28%	108 - 169 Ma N_f = 4
Unreset volcanic tuff								
C5)	Skookumchuck Fm., Centralia coal mine, Washington	33 - 51 Ma N_t = 20	(same as pooled age)	39.4 ± 1.8 Ma N_f = 19.6 W = 15.3%	Pooled age = 39.2 ± 2.7 Ma $P(\chi^2)$ = 57%			
Reference sample of unreset volcanic zircon								
F1)	Fish Canyon tuff, (internal standards for 6 irradiations)	21 - 40 Ma N_t = 72	26.3 ± 1.6 Ma N_f = 52	28.6 ± 1.6 Ma N_f = 68.4 W = 17.3%	Mean age = 28.6 ± 1.9 Ma [accepted K-Ar age = 27.9 Ma]			

NOTES: EA = expected depositional age. N_t = total number of grains analyzed. N_f = estimated number of grains in a specific peak or fraction. All uncertainties are cited at ± 2 standard error and include group error. W = estimated relative standard deviation for a peak, expressed in percentage of the peak age. * = youngest peak coincides with the ~43 Ma P_1 peaks. n.d. = not detected.

Table 3. Zircon FT results for the western group of unreset samples from the Olympic subduction complex

Lab#)	Geologic Unit, Location	Age Range, Number of Grains	Youngest Fraction		Older Peaks			Oldest Fraction
			χ^2 Age	Youngest Peak	(~43 Ma)	(~57 Ma)	(~74 Ma)	(> ~100 Ma)
ZD38)	Western Olympic Assemblage, SE of Forks	31 - 279 Ma N_t = 61	46.8 ± 3.1 Ma N_f = 23	41.0 Ma* N_f = 12 W = 18%	41 Ma*	65 Ma N_f = 27 W = 23%	81 Ma N_f = 15 W = 23%	110 - 279 Ma N_f = 7
ZD22)	?Western Olympic Assem., North Fork Ranger Station	23 - 84 Ma N_t = 50	31.5 ± 2.0 Ma N_f = 28	30.8 Ma N_f = 23 W = 17%	44 Ma N_f = 20 W = 17%	62 Ma N_f = 3 W = 11%	78 Ma N_f = 4 W = 14%	- n.d. -
ZD44)	?Western Olympic Assemblage, NW of Quinault Lk.	37 - 180 Ma N_t = 25	48.2 ± 3.4 Ma N_f = 16	47.0 Ma* N_f = 13 W = 17%	47 Ma*	- n.d. -	69 Ma N_f = 10 W = 21%	125 - 180 Ma N_f = 2
ZD50)	Western Olympic Assemblage, Glacier Creek	24 - 101 Ma N_t = 25	26.9 ± 3.2 Ma N_f = 4	24.6 Ma N_f = 3 W = 11%	45 Ma N_f = 11 W = 18%	- n.d. -	73 Ma N_f = 9 W = 15%	97 - 101 Ma N_f = 2
ZD6)	Western Olympic Assemblage, Mount Tom	14 - 195 Ma N_t = 50	19.1 ± 1.9 Ma N_f = 15	18.6 Ma N_f = 14 W = 24%	42 Ma N_f = 12 W = 18%	58 Ma N_f = 19 W = 24%	86 Ma N_f = 3 W = 16%	153 - 195 Ma N_f = 2

NOTES: N_t = total number of grains analyzed. N_f = estimated number of grains in a specific peak or fraction. All uncertainties are cited at ± 2 standard error and include group error. W = estimated relative standard deviation for a peak, expressed in percentage of the peak age.
* = youngest peak coincides with the ~43 Ma P_1 peaks. n.d. = not detected.

Table 4. Zircon FT results for the eastern group of unreset samples from the Olympic subduction complex

Lab#)	Geologic Unit, Location	Age Range, Number of Grains	Youngest Fraction		Older Peaks			Oldest Fraction
			χ^2 Age	Youngest Peak	(~43 Ma)	(~57 Ma)	(~74 Ma)	(> ~100 Ma)
ZD49)	Grand Valley Assemblage, Wellesley Peak	14 - 229 Ma N_t = 55	18.8 ± 1.5 Ma N_f = 18	23.3 Ma N_f = 32 W = 24%	46 Ma N_f = 15 W = 28%	- n.d. -	76 Ma N_f = 4 W = 22%	125 - 229 Ma N_f = 2
ZD2)	Possibly Needles-Gray Wolf Assem., Hurricane Ridge	22 - 195 Ma N_t = 55	34.3 ± 2.4 Ma N_f = 18	31.9 Ma N_f = 10 W = 21%	49 Ma N_f = 32 W = 20%	69 Ma N_f = 2 W = 9%	94 Ma N_f = 9 W = 29%	110 - 195 Ma N_f = 4
ZD7)	Needles-Gray Wolf Assemblage, Sunnybrook Meadows	28 - 389 Ma N_t = 60	39.2 ± 2.7 Ma N_f = 19	37.4 Ma* N_f = 11 W = 16%	37 Ma*	53 Ma N_f = 36 W = 18%	78 Ma N_f = 6 W = 21%	119 - 389 Ma N_f = 5
ZD33)	Needles-Gray Wolf Assemblage, Tyler Peak	26 - 184 Ma N_t = 50	37.6 ± 2.6 Ma N_f = 13	41.9 Ma N_f = 21 W = 18%	42 Ma*	64 Ma N_f = 15 W = 15%	83 Ma N_f = 9 W = 14%	108 - 184 Ma N_f = 4
ZD4)	Probably Needles-Gray Wolf Assem., Skokomish River	28 - 126 Ma N_t = 48	32.6 ± 2.4 Ma N_f = 16	29.8 Ma N_f = 8 W = 10%	41 Ma N_f = 19 W = 15%	61 Ma N_f = 16 W = 24%	- n.d. -	108 - 126 Ma N_f = 4
ZD5)	Possibly Needles-Gray Wolf Assem., W of Staircase Station	29 - 83 Ma N_t = 49	37.3 ± 2.8 Ma N_f = 18	33.8 Ma N_f = 9 W = 15%	- n.d. -	56 Ma N_f = 40 W = 23%	- n.d. -	- n.d. -

NOTES: N_t = total number of grains analyzed. N_f = estimated number of grains in a specific peak or fraction. All uncertainties are cited at ± 2 standard error and include group error. W = estimated relative standard deviation for a peak, expressed in percentage of the peak age.
* = youngest peak coincides with the ~43 Ma P_1 peaks. n.d. = not detected.

Table 5. Zircon FT results for reset samples from the Olympic subduction complex

Lab#)	Geologic Unit, Location	Age Range, Number of Grains	Mean Age	χ^2 Age	Best-Fit Peaks	
					Young Peak	Old Peak
ZR17)	Western Olympic Assemblage, Humes Glacier	10 - 36 Ma N_t = 50	19.1 ± 2.2 Ma	14.4 ± 1.0 Ma N_f = 32	14.3 ± 0.7 Ma N_f = 28 W = 21%	25.1 ± 1.7 Ma N_f = 22 W = 29%
ZR9)	Western Olympic Assemblage, Queets Glacier	6 - 33 Ma N_t = 50	17.1 ± 1.7 Ma	10.3 ± 1.0 Ma N_f = 9	14.4 ± 0.6 Ma N_f = 27 W = 24%	20.1 ± 1.2 Ma N_f = 23 W = 33%
ZR46)	Grand Valley Assemblage, W of Hayden Pass	10 - 23 Ma N_t = 20	14.9 ± 1.6 Ma	13.7 ± 1.0 Ma N_f = 16	13.1 ± 0.8 Ma N_f = 10 W = 19%	16.9 ± 3.9 Ma N_f = 10 W = 22%
ZR48)	Elwha Assemblage, Mount Fromme	12 - 26 Ma N_t = 50	17.1 ± 1.3 Ma	15.4 ± 0.9 Ma N_f = 36	14.5 ± 0.7 Ma N_f = 21 W = 15%	19.0 ± 1.2 Ma N_f = 29 W = 20%

NOTES: N_t = total number of grains analyzed. N_f = estimated number of grains in a specific peak or fraction.
All uncertainties are cited at ± 2 standard error and include group error.
W = estimated relative standard deviation for a peak, expressed in percentage of the peak age.

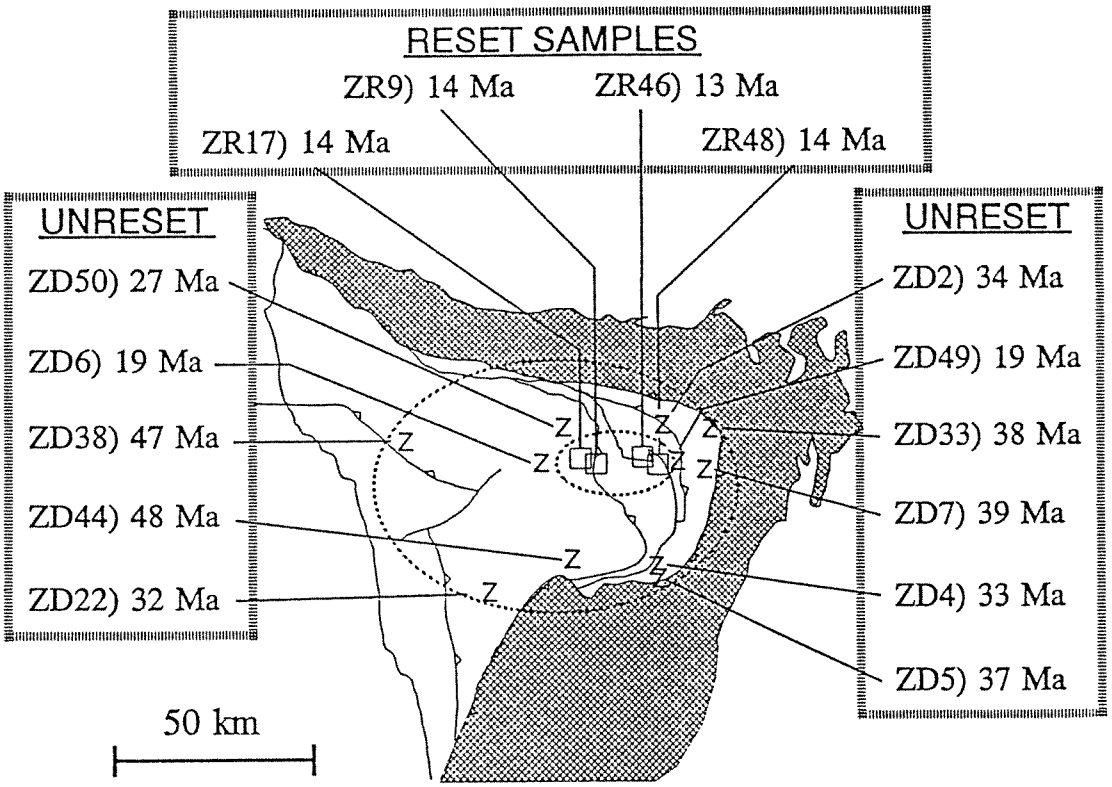

Figure 3. Summary map of zircon FT ages from the OSC. χ^2 ages are reported for the unreset samples (Tables 2-4). Youngest peak ages are reported for the reset samples (Table 5). The prefixes "ZD" and ZR" in the laboratory sample numbers indicate unreset and reset samples, respectively. On the map, unreset samples are plotted with a "Z," and reset samples with a box. The inner dashed line encloses the reset zircon localities. The outer dashed line encloses an area where apatite FT ages for OSC sandstones are total reset and yield cooling ages less than 12 Ma (Roden, Brandon, and Miller, 1990). This area cooled through the apatite closure temperature (~115°C) while the Olympic Mountains were being uplifted and denuded.

The χ^2 ages suggest that the samples were deposited over a broad interval of time, about 30 Myr (~48 to 19 Ma). The younger χ^2 ages (19 and 27 Ma) come from locations near Mount Olympus, whereas the older χ^2 ages are from the westernmost part of the Western Olympic assemblage and its presumed extensions. The 30 Myr span in ages and their separation on the map into two age groups suggests that the Western Olympic assemblage may include more than one stratigraphic unit.

Eastern group of OSC samples. This group consists of 6 samples collected from the Grand Valley and Needles-Gray Wolf assemblages of Tabor and Cady (1978b), exposed along the eastern perimeter of the OSC (Table 4, Fig. 3). In general, there is good agreement between the χ^2 ages and youngest peak ages (Table 4), with the exception of sample ZD49 (discussed below). Once again, peak widths for most of the youngest peaks suggest derivation from a single-age FT source.

Two samples were collected from the Grand Valley assemblage of Tabor and Cady (1978b). Sample ZD49 from Wellesley Peak has a χ^2 age of 19 Ma, which is significantly younger than the age of its youngest best-fit peak at 23 Ma. The width of this youngest peak is large (W = 24 percent) indicating that the peak contains zircons derived from a composite FT source. In this case, the χ^2 age provides a better estimate of the FT age of the youngest grain-age population in this sample.

Sample ZD2 from Hurricane Ridge was also collected from outcrops mapped as Grand Valley assemblage, but it gives a much older χ^2 age of 34 Ma. It seems unlikely that both of these samples are from the same stratigraphic unit because of the significant contrast in their apparent ages (15 Myr = 34 Ma - 19 Ma). The younger

of the two "Grand Valley" samples, ZD49 from Wellesley Peak (χ^2 age = 19 Ma; Table 4), appears to be the same age as one of the samples from the western group of unreset OSC samples, ZD6 from Mount Tom (χ^2 age = 19 Ma; Table 3). This similarity in age suggests that parts of the Western Olympic assemblage may be equivalent to parts of the Grand Valley assemblage.

The older of the two "Grand Valley" samples, ZD2 from Hurricane Ridge (χ^2 age = 34 Ma, Table 4), was collected immediately west of a mapped contact separating the Grand Valley assemblage from the Needles-Gray Wolf assemblage lying to the east. It has a χ^2 age similar to those obtained for unreset samples from the Needles-Gray Wolf assemblage (discussed below; see Fig. 3). Brandon and Vance (1992) have argued that ZD2 from Hurricane Ridge actually belongs to the Needles-Gray Wolf assemblage. This interpretation would only require a small westward shift (~100 m) in the mapped position of the contact, which is not particularly well defined at the sample locality (Tabor, Yeats, and Sorensen, 1972). Alternatively, the Grand Valley assemblage may include a larger range of stratigraphic ages or sample ZD2 may simply lack young zircon.

Two sandstones (ZD7, ZD33) were collected from well mapped parts of the Needles-Gray Wolf assemblage in the northeastern part of the OSC. Another sample (ZD4) was collected from unit Tsc of Tabor and Cady (1978b), which is probably a southern continuation of the Needles-Gray Wolf. All 3 samples show a tight cluster of χ^2 ages in the range 39 to 33 Ma. Furthermore, the χ^2 ages and youngest peak ages agree well, and the widths of the youngest peaks are consistent with a single-age source.

A fourth sample (ZD5) was collected from an area mapped as the "basaltic facies" of the Blue Mountain unit (Tbmb of Tabor and Cady, 1978b; also see Tabor, 1982), but the sampled rocks are more likely part of the Needles-Gray Wolf assemblage. Mapping in the northeast part of the Olympics (Tabor and Cady, 1978b; Einarsen, 1987) has shown that the Blue Mountain unit stratigraphically underlies and is interbedded with the Lower Eocene basalts of the Crescent Formation. Relationships are not as clear in the southeast where sample ZD5 was collected. We were unable to find a stratigraphic relationship between the sandstone unit that we sampled and nearby exposures of lower Crescent Formation (red limestone and pillow basalt). Furthermore, the dated sandstone is not basaltic but instead is composed mainly of quartz and plagioclase with minor plutonic and volcanic lithic clasts, biotite, and rare muscovite. The heavy mineral fraction yielded abundant epidote and garnet. The χ^2 age for sample ZD5 is 37 Ma, which is about 17 Myr younger than the age of the Crescent Formation (~54 Ma for the upper Crescent; Duncan, 1982). Map patterns (Tabor, 1982) suggest that the dated sandstone is structurally interleaved with lower Crescent basalts. Thus, it is possible that the dated locality lies within a tectonic slice of the Needles-Gray Wolf assemblage. Tabor (1982) has identified rocks equivalent to the Needles-Gray Wolf assemblage (unit Tsc of Tabor, 1982) as lying just 2 km to the north of locality ZD5.

Reset OSC samples

The four reset samples (Table 5) are from the central part of the OSC (Fig. 3) and coincide with the area of highest metamorphic grade (Brandon and Calderwood, 1990). These samples differ markedly from the unreset samples, in that their grain ages are relatively young (6 to 36 Ma), and their grain age distributions span a fairly narrow age range (13 to 27 Myr). Furthermore, their composite probability density plots show a single narrow peak, rather than the broad polymodal distributions that characterize the unreset samples (Brandon and Vance, 1992).

The interpretation of these data, however, in terms of specific cooling ages is difficult because all the samples fail the χ^2 test, indicating that, in addition to the radioactive decay process, there are other sources of variability affecting the grain ages in each distribution. Experiments, both in the laboratory (Tagami, Ito, and Nishimura, 1990) and under well controlled natural conditions (Green and others, 1989), have shown that FT data from partially annealed apatites and zircons commonly do not pass the χ^2 test. This result might be anticipated for a detrital population because the population would have had an initially wide variation in FT grain ages, prior to annealing. However, Tagami, Ito, and Nishimura (1990) found the same result in their experiments where they partially annealed single-age populations of volcanic zircons that prior to annealing had passed the χ^2 test. Their experiments indicate that the rate of annealing and the associated reduction of apparent FT ages varies from grain to grain within a population that otherwise started with a common FT age.

In light of these problems, how do we assign cooling ages to the reset samples? Green (1981) suggests that the mean age should be used for samples that fail the χ^2 test. This approach requires that there are no systematic biases among the grain ages, which does not appear to be the case for our reset samples. One approach is

to assume that the youngest FT grain ages in the reset samples are associated with the most completely annealed zircon, in which case, the age of the youngest best-fit peak should provide a good estimate of the cooling age. Seward and Rhoades (1986) use a similar argument for interpreting partially reset zircon FT ages from the Alpine fault of New Zealand. The youngest peak ages for our reset samples are tightly clustered about an average of 14 Ma (Table 5), which is accepted as the cooling age for these samples (Fig. 3).

GEOLOGIC IMPLICATIONS

The FT data of Brandon and Vance (1992) helps to define the form and age of the Olympics uplift. The concentric distribution of FT ages clearly indicates the Olympics uplift has a dome-like structure. The reset samples define an area about 30 km across (inner dashed line in Fig. 3) that coincides with the central and most deeply exhumed part of the Olympic Mountains. Mount Olympus, the highest summit in the Olympic Mountains (2427 m), lies within the reset area on its west side. Maximum metamorphic grade is also attained in this area (Brandon and Calderwood, 1990).

Outside of this central area, χ^2 ages from unreset samples become progressively older with increasing distance from the reset area (Fig. 3). Unreset samples from just outside the perimeter of the central reset area have χ^2 ages of 27 to 19 Ma, indicating Late Oligocene and Early Miocene depositional ages. At a still greater distance, the χ^2 ages are clustered between 48 to 32 Ma indicating Middle Eocene to Early Oligocene depositional ages. Of course, we are assuming that the χ^2 age is a reasonable proxy for the depositional age of the sandstone.

The domal structure of the OSC is also apparent in the apatite FT dating of Roden, Brandon, and Miller (1990). The outer dashed line in Figure 3 encloses all apatite localities that cooled during uplift of the Olympic Mountains (apatite ages less than 12 Ma).

REFERENCES CITED

Armstrong, R. L.; Ward, P., 1991, Evolving geographic patterns of Cenozoic magmatism in the North American Cordillera—The temporal and spatial association of magmatism and metamorphic core complexes: Journal of Geophysical Research, v. 96, no. B8, p. 13201-13224.

Brandon, M. T., 1992, Decomposition of fission-track grain-age distributions, American Journal of Science, October issue.

Brandon, M. T.; Calderwood, A.R., 1990, High-pressure metamorphism and uplift of the Olympic subduction complex: Geology, v. 18, no. 12, p. 1252-1255.

Brandon, M. T.; Vance, J. A., 1992, Fission-track ages of detrital zircon grains: implications for the tectonic evolution of the Cenozoic Olympic subduction complex: American Journal of Science, October issue.

Carpenter, B. S.; Reimer, G. M., 1974, Calibrated glass standards for fission-track use: National Bureau of Standards Special Publication, number 260-49, 17 p.

Duncan, R. A., 1982, A captured island chain in the Coast Range of Oregon and Washington: Journal of Geophysical Research, v. 87, no. B13, p. 10827-10837.

Einarsen, J. M., 1987, The petrography and tectonic significance of the Blue Mountain unit, Olympic Peninsula, Washington: Western Washington University Master of Science thesis 175 p.

Galbraith, R. F., 1981, On statistical models for fission track counts: Journal of the International Association for Mathematical Geology, v. 13, no. 6, p. 471-478.

Galbraith, R. F.; Green, P. F., 1990, Estimating the component ages in a finite mixture: Nuclear Tracks and Radiation Measurements, v. 17, no. 3, p. 197-206.

Gleadow, A. J. W., 1981, Fission-track dating methods: what are the real alternatives?: Nuclear Tracks, v. 5, p. 3-14.

Green, P. F., 1981, A new look at statistics in fission-track dating: Nuclear Tracks, v. 5, p. 77-86.

Green, P. F., 1985, Comparison of zeta calibration baselines for fission-track dating of apatite, zircon, and sphene: Chemical Geology (Isotope Geoscience Section), v. 58, p. 1-22.

Green, P. F.; Hurford, A. J., 1984, Thermal neutron dosimetry for fission track dating: Nuclear Tracks, v. 9, p. 231-241.

Green, P. F.; Duddy, I. R.; Gleadow, A. J. W.; Lovering, J. F., 1989, Apatite fission-track analysis as a paleotemperature indicator for hydrocarbon exploration. *In* Naeser, N. D.; McCulloh, T. H., editors, Thermal history of sedimentary basins—Methods and case histories: Springer-Verlag, p. 181-195.

Heller, P. L.; Tabor, R. W.; O'Neil, J. R.; Pevear, D. R.; Shafiqullah, Muhammad; Winslow, N. S., 1992, Isotopic provenance of Paleogene sandstones from the accretionary core of the Olympic Mountains, Washington: Geological Society of America Bulletin, v. 104, no. 2, p. 140-153.

Hurford, A. J.; Green, P. F., 1983, The zeta age calibration of fission-track dating: Chemical Geology, v. 41, no. 4, p. 285-317.

Hurford, A. J.; Fitch, F. J.; Clarke, A., 1984. Resolution of the age structure of the detrital zircon populations of two Lower Cretaceous sandstones from the Weald of England by fission track dating: Geological Magazine, v. 121, no. 4, p. 269-277.

Kasuya, Masao; Naeser, C. W., 1988, The effect of α-damage on fission-track annealing in zircon: Nuclear Tracks and Radiation Measurements, v. 14, no. 4, p. 477-480.

McLachlan, G. J.; Basford, K. E., 1988, Mixture models—Inference and applications to clustering: Marcel Dekker, Inc., 253 p.

Naeser, N. D.; Zeitler, P. K.; Naeser, C. W.; Cerveny, P. F., 1987, Provenance studies by fission-track dating of zircon—Etching and counting procedures: Nuclear Tracks and Radiation Measurements, v. 13, no. 213, p. 121-126.

Naeser, N. D.; Naeser, C. W.; McCulloh, T. H., 1989, The application of fission-track dating to the depositional and thermal history of rocks in sedimentary basins. *In* Naeser, N. D.; McCulloh, T. H., editors, Thermal history of sedimentary basins—Methods and case histories: Springer-Verlag, p. 157-180.

Potts, P. J., 1987, A handbook of silicate rock analysis: Chapman and Hall, 622 p.

Roberts, J. H.; Gold, R.; Armani, R. J., 1968, Spontaneous fission decay constant of ^{238}U: Physics Review, v. 174, p. 1482-1484.

Roden, M. K.; Brandon, M. T.; Miller, D. S., 1990, Apatite fission-track thermochronology of the Olympic subduction complex, Washington [abstract]: Geological Society of America Abstracts with Programs, v. 22, no. 7, p. A324.

Seward, Diane; Rhoades, D. A., 1986, A clustering technique for fission-track dating of fully to partially annealed minerals and other non-unique populations: Nuclear Tracks and Radiation Measurements, v. 11, no. 4-5, p. 259-268.

Tabor, R. W., 1982, Geologic map of the Wonder Mountain Roadless Area, Mason County, Washington: U.S. Geological Survey Miscellaneous Field Studies Map MF-1418-A, 1 sheet, scale 1:62,500.

Tabor, R. W.; Cady, W. M., 1978a, The structure of the Olympic Mountains, Washington—Analysis of a subduction zone: U.S. Geological Survey Professional Paper 1033, 38 p.

Tabor, R. W.; Cady, W. M., 1978b, Geologic map of the Olympic Peninsula, Washington: U.S. Geological Survey Map I-994, 2 sheets, scale 1:125,000.

Tabor, R. W.; Yeats, R. S.; Sorensen, M. L., 1972, Geologic map of the Mount Angeles quadrangle, Clallam and Jefferson Counties, Washington: U.S. Geological Survey Geological Quadrangle Map GQ-958, 1 sheet, scale 1:62,500.

Tagami, Takahiro; Ito, Hisatoshi; Nishimura, Susumu, 1990, Thermal annealing characteristics of spontaneous fission tracks in zircon: Chemical Geology (Isotope Geoscience Section) v. 80, no. 2, p. 159-169.

Triplehorn, D. M.; Turner, D. L.; Frizzell, V. A., Jr., 1980, Stratigraphic significance of radiometric ages for Eocene coals in western Washington [abstract]. *In* Carter, L. M., editor, Proceedings of the fourth symposium on the geology of Rocky Mountain coal: Colorado Geological Survey Resources Series 10, p. 87.

Turner, D. L.; Frizzell, V. A., Jr.; Triplehorn, D. M.; Naeser, C. W., 1983, Radiometric dating of ash partings in coal of the Eocene Puget Group, Washington—Implications for paleobotanical stages: Geology, v. 11, no. 9, p. 527-531.

Walsh, T. J.; Korosec, M. A.; Phillips, W. M.; Logan, R. L.; Schasse, H. W., 1987, Geologic map of Washington—Southwest quadrant: Washington Division of Geology and Earth Resources Geologic Map GM-34, 2 sheets, scale 1:250,000, with 28 p. text.

APPENDIX A

This appendix contains locality descriptions for the zircon FT samples. The following format is used: laboratory number (field number, latitude, longitude), followed by the locality description. The prefix for the field number identifies the geologist who collected the sample (unless noted otherwise): "V" for J. A. Vance, "ARC" for A. R. Calderwood and M. T. Brandon, and "8" for M. T. Brandon. The laboratory number includes a prefix of C for the Eocene basin samples, F for the Fish Canyon tuff reference, ZD for an unreset OSC sample, and ZR for a reset OSC sample. A note is included for those OSC samples that have also yielded apatite FT ages (apatite ages are indicated by the prefix "AR", followed by the laboratory number for the sample). The apatite results will be the subject of another paper.

C1 (V351, 47° 20.9', -121° 59.1') Fluvial sandstone from the upper part of the undivided Puget Group. Collected from a large open pit quarry 1.5 km south of Ravensdale Lake, near Ravensdale, Washington. This locality lies about 6 km north of the Green River gorge section of the Puget Group, which was dated by Turner and others (1983) using plagioclase K-Ar and apatite FT methods. The Ravensdale locality probably lies near the top of the Puget Group, whereas the good K-Ar ages of Turner and others (1983) were collected from the middle of the Puget Group, at about 1025 to 1540 m below the top of the unit.

C2 (V331, 46° 40.9', -123°, 02.2') Fossiliferous, shallow marine sandstone from the Skookumchuck Formation near Centralia, Washington. Collected south of Centralia from the large borrow pit on the east side of the highway near Yardbird's Store. Walsh and others (1987, p. 13) provides stratigraphic details for the Skookumchuck. The unit has yielded foraminifera referable to the late Narizian stage and several isotopic ages that indicate an age of about 40 Ma (see C5 below). The Skookumchuck is stratigraphically equivalent to the upper Cowlitz Formation and overlies the Stillwater Member of the Cowlitz Formation from which sample C3 was collected.

C3 (V450, 46° 23.8', -123° 02.9') Marine sandstone from the Stillwater Member of the Cowlitz Formation, collected 3 km north of Ryderwood, Washington, on the road along the lower part of Owen Creek. See Walsh and others (1987, p. 11) for stratigraphic details. The unit has yielded foraminifera referable to the Narizian stage, which approximately corresponds to the interval 48 to 37.5 Ma. This unit stratigraphically underlies the Skookumchuck Formation and therefore should be older than sample C2 above.

C4 (V403, 45° 42.48', -123° 20.01') Sandstone from the Cowlitz Formation. Collected by Ray Wells from an outcrop about 3.5 km west of Timber, Oregon, in Reeher Forest Park. In Washington, the Cowlitz Formation is assigned to the upper Narizian (Walsh and others, 1987, p. 11). The Narizian stage approximately corresponds to the interval 48 to 37.5 Ma; the age of the upper/middle Narizian boundary is, at present, poorly resolved.

C5 (V335, approximate location: 46° 43', -122° 58') Volcanic ash from the Skookumchuck Formation. Collected from the Centralia coal mine. Triplehorn, Turner, and Frizzell (1980) report an average of 40 Ma for 6 K-Ar feldspar ages from ash beds at the coal mine.

F1 Volcanic zircon from the Fish Canyon tuff, a widely used reference sample, which has a well determined K-Ar age of 27.9 ± 0.7 (± 2s) (Hurford and Green, 1983).

ZD38 (ARC88-16, 47° 50.80', -124° 12.15') Sandstone from unit Two of the Western Olympic assemblage (Tabor and Cady, 1978b). Collected southeast of Forks on logging road H3200 at 1665 feet (508 m). (From same sample as AR38.)

ZD22 (8782-2, 47° 33.38', -123° 40.05') Sandstone from unit Tur (Tabor and Cady, 1978b). Collected 2.9 km south on the road from the North Fork Ranger Station from an outcrop on the west side of a road at 510 feet (155 m). Unit Tur represents an undifferentiated part of the OSC which is tentatively include with the Western Olympic assemblage.

ZD44 (ARC88-22, 47° 29.08', -123° 57.55') Sandstone from unit Tur (Tabor and Cady, 1978b). Collected on USFS Road #2460 west of Quinault Lake at 600 feet (183 m). Unit Tur represents an undifferentiated part of the OSC which is tentatively include with the Western Olympic assemblage.

ZD50 (8892-1, 47° 52.55', -123° 41.60') Sandstone from unit Twog ("green sandstone") of the Western Olympic assemblage (Tabor and Cady, 1978b). Collected by D. Coffey from an outcrop on the south side of the Hoh River bridge at the confluence of Glacier Creek and Hoh River. Elevation is 1340 feet (408 m).

ZD6 (V312, 47° 47.61', -123° 45.44') Sandstone from unit Two of the Western Olympic assemblage (Tabor and Cady, 1978b). Collected by R.J. Stewart from summit of Mount Tom at about 7048 feet (2148 m).

ZD49 (8889-2, 47° 47.48', -123° 17.47') Sandstone from unit Tgst of the Grand Valley assemblage (Tabor and Cady, 1978b). Collected by D. Coffey from the summit of Wellesley Peak at 6758 feet (2060 m). (From same sample as AR49.)

ZD2 (86L-2, 47° 54.93', -123° 22.61') Sandstone collected at Hurricane Ridge in the vicinity of the Gray Wolf fault at 6300 feet (1920 m). The Gray Wolf fault separates the Grand Valley assemblage to the west from the Needles-Gray Wolf assemblage to the east (Tabor, Yeats, and Sorensen, 1972). The contact is not located well enough in the sample area to distinguish which unit was sampled. In the text, it is argued that this sample probably corresponds to the Needles-Gray Wolf assemblage (unit Tnm of Tabor and Cady, 1978b). (From same sample as AR2.)

ZD7 (V441, 47° 46.12', -123° 11.62') Sandstone of unit Tnm of the Needles-Gray Wolf assemblage (Tabor and Cady, 1978b). Collected along the trail to Sunnybrook Meadows at 5250 feet (1600 m). Tabor and Cady (1978b) show a large fold in this area.

ZD33 (ARC88-11, 47° 52.60', -123° 08.70') Sandstone from unit Tnm of the Needles-Gray Wolf assemblage (Tabor and Cady, 1978b). Collected 0.5 km west of the Hurricane Ridge fault on an old logging road west of USFS Road #2825 at 3080 feet (939 m).

ZD4 (V240, 47° 32.58', -123° 22.36') Sandstone from unit Tsc of Tabor and Cady (1978b), probably a southern continuation of the Needles-Gray Wolf assemblage. Collected from the trail along the North Fork of the Skokomish River, just north of the southern fault zone at 1450 feet (442 m).

ZD5 (V241, 47° 30.42', -123° 21.77') Sandstone from a unit that Tabor and Cady (1978b) describe as the "basaltic facies" of the Blue Mountain unit (Tbmb) (see Tabor, 1982, for further details). Collected on Road #2347, N of Elk Creek and W of Staircase Ranger Station, at the approximate elevation of 3200 feet (976 m). Vance and Brandon returned to this locality during the summer of 1990. A stratigraphic relationship was not found between the sampled unit and nearby exposures of red limestone and pillow basalt, which belong to the lower Crescent Formation. Furthermore, the sandstone is not basaltic but instead is composed mainly of quartz and plagioclase with minor plutonic and volcanic lithic clasts, biotite, and rare muscovite. The heavy mineral fraction contains abundant epidote and garnet. Map patterns shown in Tabor (1982) suggest that the dated sandstone unit may be structurally interleaved with the lower Crescent Formation. An assignment to the Blue Mountain unit is not compelling. This locality is tentatively included with unit Tsc of Tabor and Cady (1978b) which has been mapped to within 2 km of the sample locality. Unit Tsc is probably a southern continuation of the Needles-Gray Wolf assemblage.

ZR17 (87727-1, 47° 47.34', -123° 38.09') Well bedded sandstone from unit Twog ("green sandstone") of the Western Olympic assemblage (Tabor and Cady, 1978b). Collected at the base of Humes Glacier at 4720 feet (1439 m). (From same sample as AR17.)

ZR9 (87716-2, 47° 46.73', -123° 35.70') Well bedded sandstone from unit Twog ("green sandstone") of the Western Olympic assemblage (Tabor and Cady, 1978b). Collected from the area east of the Queets Glacier and northeast of peak 5819 at 5460 feet (1665 m).

ZR46 (8887-1, 47° 49.34', -123° 25.94') Sandstone from unit Tgs of the Grand Valley assemblage (Tabor and Cady, 1978b). Collected near the trail west of Hayden Pass at 3100 feet (945 m). (From same sample as AR46.)

ZR48 (8889-1, 47° 47.66', -123° 21.68') Well bedded sandstone from unit Tess of the Elwha assemblage (Tabor and Cady, 1978b). Collected at 6500 feet (1982 m) on Mount Fromme from strata depositionally overlying Eocene basalts exposed there. (From same sample as AR48.)

APPENDIX B

This appendix contains the original FT grain-age data for samples discussed in this paper, which consist of 15 samples from the Olympics, 5 from Eocene basins, and a composite result for Fish Canyon tuff dated in 6 irradiations.

For each sample, the data are listed in two formats. The first, labeled "Grain ages in original order", contains the original data. Ns and Ni are the actual tracks counted, spontaneous and induced, respectively. Poisson statistics are calculated using these values. RhoS and RhoI are the spontaneous and induced track densities. The count area is indicated by the number of squares covered where the size of the counting square is 8.46×10^{-7} cm^2. Data on the neutron irradiation are listed next. In a few cases, a sample may contain grains from two or more irradiations, as indicated by a change in the neutron fluence. RhoD is the track density produced by the SRM 962 glass standard. For those cases where Fish Canyon zircon was used to measure fluence, RhoD gives the effective track density that would have been observed if the SRM 962 glass standard were used. Phi is the measured neutron fluence. Age is the calculated grain age.

The second format, labeled "Grain ages ordered with increasing age", shows how the $P(\chi^2)$, the chi-square probability, changes as increasingly older grains are added to the distribution. RhoS, Ns, RhoI, Ni, and grain age are as described above. The uranium content of each grain is estimated using the formula in Potts (1987) and an effective U content for SRM 962 glass of 12.5 ppm (Green, 1981). $P(\chi^2)$ listed to the right of each grain age gives the probability that the variability of ages among the group of grains with ages less than and equal to the current grain age is due to chance alone. Sum age ± 2s gives the pooled age and uncertainty for this young group of grains. The χ^2 age is designated as the sum age adjacent to the smallest $P(\chi^2)$ still greater than 1 percent. It represents the age of the youngest group of plausibly related grain ages in the sample. For reset samples, the youngest peak age as determined by the peak-fit method is designated as the cooling age (see text for discussion).

Date, Time: 01-15-1991 09:35:12 Filename: PUGET.FTZ
Lab# C1 Field# V351 Upper Puget Group, SW Washington, Vance 12/10/86
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	1.98	(94)	2.70	(128)	56	2.09	1.070	3.90	23.5	6.4
2	2.33	(71)	2.56	(78)	36	2.09	1.070	3.90	29.1	9.6
3	4.07	(131)	3.92	(126)	38	2.09	1.070	3.90	33.2	8.4
4	1.92	(117)	1.82	(111)	72	2.09	1.070	3.90	33.7	9.0
5	4.12	(122)	3.85	(114)	35	2.09	1.070	3.90	34.2	9.0
6	5.63	(162)	4.76	(137)	34	2.09	1.070	3.90	37.8	8.9
7	6.35	(188)	5.20	(154)	35	2.09	1.070	3.90	39.0	8.6
8	0.83	(44)	0.66	(35)	63	2.09	1.070	3.90	40.1	18.2
9	6.15	(156)	4.89	(124)	30	2.09	1.070	3.90	40.2	9.8
10	2.54	(86)	1.98	(67)	40	2.09	1.070	3.90	41.0	13.4
11	5.26	(138)	4.00	(105)	31	2.09	1.070	3.90	41.9	11.0
12	4.26	(90)	3.22	(68)	25	2.09	1.070	3.90	42.2	13.7
13	4.29	(196)	3.09	(141)	54	2.09	1.070	3.90	44.4	9.9
14	3.95	(107)	2.81	(76)	32	2.09	1.070	3.90	44.9	13.6
15	6.17	(188)	4.33	(132)	36	2.09	1.070	3.90	45.4	10.5
16	6.08	(247)	4.24	(172)	48	2.09	1.070	3.90	45.8	9.3
17	4.57	(116)	3.15	(80)	30	2.09	1.070	3.90	46.3	13.6
18	6.32	(171)	4.28	(116)	32	2.09	1.070	3.90	47.0	11.5
19	5.09	(155)	3.41	(104)	36	2.09	1.070	3.90	47.5	12.2
20	6.84	(162)	4.43	(105)	28	2.09	1.070	3.90	49.2	12.5
21	8.19	(194)	4.98	(118)	28	2.09	1.070	3.90	52.4	12.4
22	4.19	(124)	2.53	(75)	35	2.09	1.070	3.90	52.7	15.6
23	2.49	(118)	1.48	(70)	56	2.09	1.070	3.90	53.8	16.4
24	7.21	(238)	4.12	(136)	39	2.09	1.070	3.90	55.8	12.2
25	3.75	(127)	2.13	(72)	40	2.09	1.070	3.90	56.2	16.7
26	4.35	(103)	2.41	(57)	28	2.09	1.070	3.90	57.6	19.2
27	8.95	(265)	4.86	(144)	35	2.09	1.070	3.90	58.7	12.4
28	6.97	(165)	3.76	(89)	28	2.09	1.070	3.90	59.1	15.7
29	4.17	(141)	2.16	(73)	40	2.09	1.070	3.90	61.6	17.9
30	5.56	(141)	2.80	(71)	30	2.09	1.070	3.90	63.3	18.6
31	5.87	(149)	2.84	(72)	30	2.09	1.070	3.90	65.9	19.1
32	2.99	(124)	1.42	(59)	49	2.09	1.070	3.90	66.9	21.3
33	2.43	(107)	1.14	(50)	52	2.09	1.070	3.90	68.2	23.5
34	7.59	(212)	3.37	(94)	33	2.09	1.070	3.90	71.8	18.0
35	6.61	(179)	2.77	(75)	32	2.09	1.070	3.90	76.0	21.1
36	5.87	(154)	2.29	(60)	31	2.09	1.070	3.90	81.7	25.1
37	7.29	(216)	2.80	(83)	35	2.09	1.070	3.90	82.8	21.6
38	9.51	(193)	3.45	(70)	24	2.09	1.070	3.90	87.7	24.7
39	10.56	(134)	3.78	(48)	15	2.09	1.070	3.90	88.8	30.1
40	10.35	(219)	3.69	(78)	25	2.09	1.070	3.90	89.3	23.8
41	11.64	(197)	4.02	(68)	20	2.09	1.070	3.90	92.1	26.2
42	6.08	(180)	2.03	(60)	35	2.09	1.070	3.90	95.4	28.7
43	4.95	(180)	1.59	(58)	43	2.09	1.070	3.90	98.6	30.0
44	6.62	(140)	1.99	(42)	25	2.09	1.070	3.90	105.9	37.5
45	7.09	(180)	1.97	(50)	30	2.09	1.070	3.90	114.3	36.8
46	6.44	(196)	1.77	(54)	36	2.09	1.070	3.90	115.2	35.7
47	9.20	(218)	2.32	(55)	28	2.09	1.070	3.90	125.7	38.2
48	8.27	(189)	2.06	(47)	27	2.09	1.070	3.90	127.5	41.9
49	7.16	(212)	1.35	(40)	35	2.09	1.070	3.90	167.5	58.1
50	11.36	(173)	1.38	(21)	18	2.09	1.070	3.90	258.5	119.9

Date, Time: 01-15-1991 09:35:12 Filename: PUGET.FTZ
Lab# C1 Field# V351 Upper Puget Group, SW Washington, Vance 12/10/86
Number of grains = 50
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	1.98	(94)	2.70	(128)	159	29	23.5	6.4	100.0	23.5	6.4
2	2.33	(71)	2.56	(78)	151	35	29.1	9.6	31.3	25.6	5.4
3	4.07	(131)	3.92	(126)	231	42	33.2	8.4	16.7	28.5	4.7
4	1.92	(117)	1.82	(111)	107	21	33.7	9.0	19.1	29.8	4.2
5	4.12	(122)	3.85	(114)	226	43	34.2	9.0	22.9	30.7	3.9
6	5.63	(162)	4.76	(137)	280	49	37.8	8.9	14.8	32.1	3.7
7	6.35	(188)	5.20	(154)	306	51	39.0	8.6	9.6	33.3	3.5
8	0.83	(44)	0.66	(35)	39	13	40.1	18.2	12.2	33.6	3.4
9	6.15	(156)	4.89	(124)	287	53	40.2	9.8	10.1	34.4	3.3
10	2.54	(86)	1.98	(67)	116	29	41.0	13.4	10.8	34.8	3.2
11	5.26	(138)	4.00	(105)	236	47	41.9	11.0	9.1	35.5	3.2
12	4.26	(90)	3.22	(68)	189	46	42.2	13.7	9.5	35.8	3.1
13	4.29	(196)	3.09	(141)	182	31	44.4	9.9	5.3	36.7	3.1
14	3.95	(107)	2.81	(76)	165	38	44.9	13.6	4.7	37.1	3.0
15	6.17	(188)	4.33	(132)	255	45	45.4	10.5	3.0	37.8	3.0
16	6.08	(247)	4.24	(172)	249	39	45.8	9.3	1.6	38.6	2.9
17	4.57	(116)	3.15	(80)	185	42	46.3	13.6	1.6	38.9	2.9
18	6.32	(171)	4.28	(116)	252	48	47.0	11.5	1.2	39.4	2.8
19	5.09	(155)	3.41	(104)	201	40	47.5	12.2	0.9	39.8	2.8
20	6.84	(162)	4.43	(105)	261	52	49.2	12.5	0.6	40.3	2.8
21	8.19	(194)	4.98	(118)	293	55	52.4	12.4	0.2	40.9	2.8
22	4.19	(124)	2.53	(75)	149	35	52.7	15.6	0.1	41.3	2.8
23	2.49	(118)	1.48	(70)	87	21	53.8	16.4	0.1	41.6	2.8
24	7.21	(238)	4.12	(136)	242	43	55.8	12.2	0.0	42.4	2.8
25	3.75	(127)	2.13	(72)	125	30	56.2	16.7	0.0	42.8	2.8
26	4.35	(103)	2.41	(57)	142	38	57.6	19.2	0.0	43.1	2.8
27	8.95	(265)	4.86	(144)	286	49	58.7	12.4	0.0	43.9	2.8
28	6.97	(165)	3.76	(89)	221	48	59.1	15.7	0.0	44.3	2.8
29	4.17	(141)	2.16	(73)	127	30	61.6	17.9	0.0	44.7	2.8
30	5.56	(141)	2.80	(71)	165	40	63.3	18.6	0.0	45.2	2.8
31	5.87	(149)	2.84	(72)	167	40	65.9	19.1	0.0	45.6	2.8
32	2.99	(124)	1.42	(59)	84	22	66.9	21.3	0.0	46.0	2.8
33	2.43	(107)	1.14	(50)	67	19	68.2	23.5	0.0	46.4	2.8
34	7.59	(212)	3.37	(94)	198	42	71.8	18.0	0.0	47.1	2.8
35	6.61	(179)	2.77	(75)	163	38	76.0	21.1	0.0	47.7	2.8
36	5.87	(154)	2.29	(60)	135	35	81.7	25.1	0.0	48.3	2.8
37	7.29	(216)	2.80	(83)	165	37	82.8	21.6	0.0	49.1	2.9
38	9.51	(193)	3.45	(70)	203	49	87.7	24.7	0.0	49.9	2.9
39	10.56	(134)	3.78	(48)	223	65	88.8	30.1	0.0	50.4	2.9
40	10.35	(219)	3.69	(78)	217	50	89.3	23.8	0.0	51.2	2.9
41	11.64	(197)	4.02	(68)	236	58	92.1	26.2	0.0	51.9	2.9
42	6.08	(180)	2.03	(60)	119	31	95.4	28.7	0.0	52.6	3.0
43	4.95	(180)	1.59	(58)	94	25	98.6	30.0	0.0	53.3	3.0
44	6.62	(140)	1.99	(42)	117	36	105.9	37.5	0.0	53.8	3.0
45	7.09	(180)	1.97	(50)	116	33	114.3	36.8	0.0	54.6	3.0
46	6.44	(196)	1.77	(54)	104	29	115.2	35.7	0.0	55.4	3.1
47	9.20	(218)	2.32	(55)	137	37	125.7	38.2	0.0	56.3	3.1
48	8.27	(189)	2.06	(47)	121	36	127.5	41.9	0.0	57.1	3.1
49	7.16	(212)	1.35	(40)	79	25	167.5	58.1	0.0	58.1	3.2
50	11.36	(173)	1.38	(21)	81	36	258.5	119.9	0.0	59.1	3.2
POOLED	5.27	(7909)	2.84	(4262)	167	8			0.0	59.1	3.2
MEAN AGE (using grain ratios)										69.3	11.9

Date, Time: 01-15-1991 09:35:23 Filename: V331.FTZ
Lab# C2 Field# V331 Skookumchuck, Centralia Vance, RR 4-17-85
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	2.90	(76)	2.97	(78)	31	2.13	1.090	4.18	31.7	10.3
2	6.19	(131)	6.29	(133)	25	2.13	1.090	4.18	32.0	8.0
3	6.95	(200)	5.91	(170)	34	2.13	1.090	4.18	38.3	8.1
4	8.57	(174)	7.24	(147)	24	2.13	1.090	4.18	38.5	8.8
5	11.31	(287)	9.57	(243)	30	2.13	1.090	4.18	38.4	6.9
6	4.57	(143)	3.80	(119)	37	2.13	1.090	4.18	39.1	9.8
7	11.35	(240)	9.36	(198)	25	2.13	1.090	4.18	39.4	7.7
8	5.32	(135)	4.33	(110)	30	2.13	1.090	4.18	39.9	10.4
9	13.84	(281)	10.88	(221)	24	2.13	1.090	4.18	41.3	7.6
10	7.88	(220)	5.84	(163)	33	2.13	1.090	4.18	43.9	9.3
11	2.83	(98)	2.08	(72)	41	2.13	1.090	4.18	44.2	13.9
12	3.52	(161)	2.52	(115)	54	2.13	1.090	4.18	45.5	11.3
13	10.36	(298)	7.20	(207)	34	2.13	1.090	4.18	46.8	8.7
14	6.16	(198)	4.17	(134)	38	2.13	1.090	4.18	48.0	10.9
15	2.34	(109)	1.57	(73)	55	2.13	1.090	4.18	48.5	14.8
16	10.01	(237)	6.46	(153)	28	2.13	1.090	4.18	50.3	10.6
17	9.93	(210)	6.38	(135)	25	2.13	1.090	4.18	50.5	11.3
18	5.71	(174)	3.64	(111)	36	2.13	1.090	4.18	50.9	12.6
19	8.27	(168)	5.17	(105)	24	2.13	1.090	4.18	52.0	13.1
20	17.65	(224)	10.95	(139)	15	2.13	1.090	4.18	52.4	11.5
21	4.28	(174)	2.63	(107)	48	2.13	1.090	4.18	52.8	13.2
22	12.20	(258)	7.38	(156)	25	2.13	1.090	4.18	53.7	11.1
23	4.65	(169)	2.80	(102)	43	2.13	1.090	4.18	53.8	13.7
24	3.75	(127)	2.22	(75)	40	2.13	1.090	4.18	55.0	16.2
25	8.14	(234)	4.62	(133)	34	2.13	1.090	4.18	57.1	12.6
26	4.03	(133)	2.27	(75)	39	2.13	1.090	4.18	57.6	16.8
27	11.43	(203)	6.14	(109)	21	2.13	1.090	4.18	60.5	14.6
28	6.77	(149)	3.59	(79)	26	2.13	1.090	4.18	61.2	17.2
29	3.61	(119)	1.91	(63)	39	2.13	1.090	4.18	61.3	19.3
30	14.66	(248)	7.51	(127)	20	2.13	1.090	4.18	63.4	14.1
31	12.35	(188)	6.30	(96)	18	2.13	1.090	4.18	63.6	16.2
32	7.31	(272)	3.68	(137)	44	2.13	1.090	4.18	64.4	13.8
33	6.70	(170)	3.19	(81)	30	2.13	1.090	4.18	68.1	18.6
34	15.37	(260)	7.27	(123)	20	2.13	1.090	4.18	68.6	15.3
35	8.11	(240)	3.82	(113)	35	2.13	1.090	4.18	68.9	16.0
36	11.05	(215)	5.14	(100)	23	2.13	1.090	4.18	69.8	17.1
37	8.52	(173)	3.89	(79)	24	2.13	1.090	4.18	71.0	19.5
38	7.54	(204)	3.36	(91)	32	2.13	1.090	4.18	72.7	18.6
39	5.18	(184)	2.14	(76)	42	2.13	1.090	4.18	78.5	21.7
40	4.83	(192)	1.89	(75)	47	2.13	1.090	4.18	83.0	22.9
41	6.30	(160)	2.44	(62)	30	2.13	1.090	4.18	83.6	25.3
42	7.84	(232)	2.94	(87)	35	2.13	1.090	4.18	86.4	22.0
43	10.88	(221)	4.04	(82)	24	2.13	1.090	4.18	87.3	22.9
44	10.69	(217)	3.84	(78)	24	2.13	1.090	4.18	90.1	24.1
45	14.81	(188)	5.04	(64)	15	2.13	1.090	4.18	95.1	27.8
46	3.91	(86)	1.32	(29)	26	2.13	1.090	4.18	96.0	41.4
47	10.24	(208)	3.30	(67)	24	2.13	1.090	4.18	100.5	28.5
48	6.03	(153)	1.93	(49)	30	2.13	1.090	4.18	101.1	33.4
49	11.52	(195)	3.61	(61)	20	2.13	1.090	4.18	103.4	30.7
50	3.78	(128)	1.18	(40)	40	2.13	1.090	4.18	103.5	37.8

Date, Time: 01-15-1991 09:35:23 Filename: V331.FTZ
Lab# C2 Field# V331 Skookumchuck, Centralia Vance, RR 4-17-85
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
51	10.29	(209)	3.10	(63)	24	2.13	1.090	4.18	107.3	31.2
52	9.22	(195)	2.55	(54)	25	2.13	1.090	4.18	116.7	36.2
53	10.83	(229)	2.98	(63)	25	2.13	1.090	4.18	117.5	33.8
54	10.59	(215)	2.91	(59)	24	2.13	1.090	4.18	117.8	35.0
55	13.20	(201)	3.61	(55)	18	2.13	1.090	4.18	118.1	36.3
56	4.61	(156)	1.18	(40)	40	2.13	1.090	4.18	126.0	45.0
57	8.00	(203)	2.01	(51)	30	2.13	1.090	4.18	128.5	40.6
58	7.76	(210)	1.92	(52)	32	2.13	1.090	4.18	130.4	40.8
59	14.38	(146)	3.25	(33)	12	2.13	1.090	4.18	142.7	55.3
60	7.16	(212)	1.62	(48)	35	2.13	1.090	4.18	142.5	45.9

Date, Time: 01-15-1991 09:35:23 Filename: V331.FTZ
Lab# C2 Field# V331 Skookumchuck, Centralia Vance, RR 4-17-85
Number of grains = 60
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	2.90	(76)	2.97	(78)	172	40	31.7	10.3	100.0	31.7	10.3
2	6.19	(131)	6.29	(133)	363	65	32.0	8.0	95.7	31.9	6.4
3	6.95	(200)	5.91	(170)	341	54	38.3	8.1	44.5	34.8	5.2
5	11.31	(287)	9.57	(243)	553	75	38.4	6.9	49.1	36.2	4.3
4	8.57	(174)	7.24	(147)	418	71	38.5	8.8	61.5	36.6	3.9
6	4.57	(143)	3.80	(119)	220	41	39.1	9.8	71.4	36.9	3.7
7	11.35	(240)	9.36	(198)	541	80	39.4	7.7	77.3	37.4	3.5
8	5.32	(135)	4.33	(110)	250	49	39.9	10.4	83.4	37.6	3.4
9	13.84	(281)	10.88	(221)	629	89	41.3	7.6	81.5	38.2	3.2
10	7.88	(220)	5.84	(163)	337	55	43.9	9.3	73.4	38.8	3.1
11	2.83	(98)	2.08	(72)	120	29	44.2	13.9	74.8	39.0	3.1
12	3.52	(161)	2.52	(115)	145	28	45.5	11.3	69.1	39.5	3.0
13	10.36	(298)	7.20	(207)	416	60	46.8	8.7	49.1	40.2	3.0
14	6.16	(198)	4.17	(134)	241	43	48.0	10.9	38.7	40.7	2.9
15	2.34	(109)	1.57	(73)	91	22	48.5	14.8	36.9	41.0	2.9
16	10.01	(237)	6.46	(153)	373	62	50.3	10.6	22.0	41.6	2.9
17	9.93	(210)	6.38	(135)	369	65	50.5	11.3	14.8	42.1	2.9
18	5.71	(174)	3.64	(111)	210	41	50.9	12.6	11.3	42.5	2.8
19	8.27	(168)	5.17	(105)	299	60	52.0	13.1	8.2	42.8	2.8
20	17.65	(224)	10.95	(139)	633	111	52.4	11.5	4.9	43.3	2.8
21	4.28	(174)	2.63	(107)	152	30	52.8	13.2	3.6	43.6	2.8
22	12.20	(258)	7.38	(156)	426	70	53.7	11.1	1.8	44.2	2.8
23	4.65	(169)	2.80	(102)	162	33	53.8	13.7	1.3	44.5	2.8
24	3.75	(127)	2.22	(75)	128	30	55.0	16.2	1.1	44.7	2.8
25	8.14	(234)	4.62	(133)	267	48	57.1	12.6	0.4	45.2	2.8
26	4.03	(133)	2.27	(75)	131	31	57.6	16.8	0.3	45.5	2.8
27	11.43	(203)	6.14	(109)	354	69	60.5	14.6	0.1	45.9	2.8
28	6.77	(149)	3.59	(79)	207	47	61.2	17.2	0.0	46.3	2.8
29	3.61	(119)	1.91	(63)	110	28	61.3	19.3	0.0	46.5	2.8
30	14.66	(248)	7.51	(127)	433	79	63.4	14.1	0.0	47.1	2.8
31	12.35	(188)	6.30	(96)	364	76	63.6	16.2	0.0	47.5	2.8
32	7.31	(272)	3.68	(137)	213	37	64.4	13.8	0.0	48.0	2.8
33	6.70	(170)	3.19	(81)	184	42	68.1	18.6	0.0	48.4	2.8
34	15.37	(260)	7.27	(123)	420	78	68.6	15.3	0.0	49.0	2.8
35	8.11	(240)	3.82	(113)	220	42	68.9	16.0	0.0	49.5	2.8
36	11.05	(215)	5.14	(100)	297	61	69.8	17.1	0.0	50.0	2.8
37	8.52	(173)	3.89	(79)	225	51	71.0	19.5	0.0	50.3	2.8
38	7.54	(204)	3.36	(91)	194	41	72.7	18.6	0.0	50.8	2.8
39	5.18	(184)	2.14	(76)	124	29	78.5	21.7	0.0	51.2	2.9
40	4.83	(192)	1.89	(75)	109	26	83.0	22.9	0.0	51.7	2.9
41	6.30	(160)	2.44	(62)	141	36	83.6	25.3	0.0	52.1	2.9
42	7.84	(232)	2.94	(87)	170	37	86.4	22.0	0.0	52.7	2.9
43	10.88	(221)	4.04	(82)	233	52	87.3	22.9	0.0	53.3	2.9
44	10.69	(217)	3.84	(78)	222	51	90.1	24.1	0.0	53.8	2.9
45	14.81	(188)	5.04	(64)	291	74	95.1	27.8	0.0	54.3	3.0
46	3.91	(86)	1.32	(29)	76	28	96.0	41.4	0.0	54.6	3.0
47	10.24	(208)	3.30	(67)	191	47	100.5	28.5	0.0	55.2	3.0
48	6.03	(153)	1.93	(49)	111	32	101.1	33.4	0.0	55.6	3.0
49	11.52	(195)	3.61	(61)	208	54	103.4	30.7	0.0	56.1	3.0
50	3.78	(128)	1.18	(40)	68	22	103.5	37.8	0.0	56.5	3.0

Date, Time: 01-15-1991 09:35:23 Filename: V331.FTZ
Lab# C2 Field# V331 Skookumchuck, Centralia Vance, RR 4-17-85
Number of grains = 60
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
51	10.29	(209)	3.10	(63)	179	46	107.3	31.2	0.0	57.1	3.1
52	9.22	(195)	2.55	(54)	147	41	116.7	36.2	0.0	57.6	3.1
53	10.83	(229)	2.98	(63)	172	44	117.5	33.8	0.0	58.3	3.1
54	10.59	(215)	2.91	(59)	168	44	117.8	35.0	0.0	58.9	3.1
55	13.20	(201)	3.61	(55)	209	57	118.1	36.3	0.0	59.5	3.2
56	4.61	(156)	1.18	(40)	68	22	126.0	45.0	0.0	60.0	3.2
57	8.00	(203)	2.01	(51)	116	33	128.5	40.6	0.0	60.6	3.2
58	7.76	(210)	1.92	(52)	111	31	130.4	40.8	0.0	61.2	3.2
60	7.16	(212)	1.62	(48)	94	27	142.5	45.9	0.0	61.9	3.3
59	14.38	(146)	3.25	(33)	188	66	142.7	55.3	0.0	62.3	3.3
POOLED	7.41	(11440)	3.86	(5960)	223	11			0.0	62.3	3.3
MEAN AGE (using grain ratios)										72.6	8.4

Date, Time: 01-15-1991 09:35:42 Filename: COWLITZ2.FTZ
Lab# C3 Field# V450 Cowlitz Fm., Stillwater, Washington Vance 12/19/89
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	3.72	(85)	3.37	(77)	27	2.07	1.057	5.48	34.8	11.1
2	4.36	(166)	3.31	(126)	45	2.07	1.057	5.48	41.5	10.1
3	7.26	(215)	5.44	(161)	35	2.07	1.057	5.48	42.1	9.1
4	7.31	(198)	5.47	(148)	32	2.07	1.057	5.48	42.2	9.5
5	7.73	(157)	5.57	(113)	24	2.07	1.057	5.48	43.8	11.1
6	3.81	(158)	2.68	(111)	49	2.07	1.057	5.48	44.9	11.4
7	4.20	(142)	2.93	(99)	40	2.07	1.057	5.48	45.2	12.1
8	12.02	(295)	8.15	(200)	29	2.07	1.057	5.48	46.5	8.9
9	8.79	(223)	5.95	(151)	30	2.07	1.057	5.48	46.5	10.1
10	6.95	(241)	4.70	(163)	41	2.07	1.057	5.48	46.6	9.8
11	12.83	(228)	8.16	(145)	21	2.07	1.057	5.48	49.5	10.9
12	7.76	(315)	4.83	(196)	48	2.07	1.057	5.48	50.6	9.6
13	9.34	(158)	5.85	(99)	20	2.07	1.057	5.48	50.3	13.2
14	13.50	(217)	8.03	(129)	19	2.07	1.057	5.48	53.0	12.1
15	13.81	(257)	7.84	(146)	22	2.07	1.057	5.48	55.4	11.9
16	11.52	(273)	6.50	(154)	28	2.07	1.057	5.48	55.8	11.7
17	3.69	(131)	2.08	(74)	42	2.07	1.057	5.48	55.8	16.5
18	10.34	(315)	5.78	(176)	36	2.07	1.057	5.48	56.4	11.0
19	7.93	(161)	4.38	(89)	24	2.07	1.057	5.48	57.0	15.4
20	12.17	(309)	6.74	(171)	30	2.07	1.057	5.48	56.9	11.3
21	10.07	(264)	5.49	(144)	31	2.07	1.057	5.48	57.7	12.4
22	5.88	(199)	3.13	(106)	40	2.07	1.057	5.48	59.1	14.6
23	1.44	(77)	0.73	(39)	63	2.07	1.057	5.48	62.2	24.7
24	4.48	(220)	2.26	(111)	58	2.07	1.057	5.48	62.4	14.9
25	11.48	(233)	5.71	(116)	24	2.07	1.057	5.48	63.2	14.8
26	5.59	(189)	2.69	(91)	40	2.07	1.057	5.48	65.4	17.1
27	9.61	(244)	4.61	(117)	30	2.07	1.057	5.48	65.6	15.2
28	7.30	(210)	3.37	(97)	34	2.07	1.057	5.48	68.1	17.1
29	5.20	(176)	2.39	(81)	40	2.07	1.057	5.48	68.4	18.7
30	10.71	(290)	4.95	(134)	32	2.07	1.057	5.48	68.1	14.7
31	16.89	(300)	7.49	(133)	21	2.07	1.057	5.48	71.0	15.3
32	5.70	(193)	2.51	(85)	40	2.07	1.057	5.48	71.4	19.0
33	5.25	(191)	2.31	(84)	43	2.07	1.057	5.48	71.5	19.1
34	10.64	(216)	4.58	(93)	24	2.07	1.057	5.48	73.1	18.6
35	4.93	(200)	2.07	(84)	48	2.07	1.057	5.48	74.9	19.9
36	9.51	(177)	3.98	(74)	22	2.07	1.057	5.48	75.2	21.2
37	8.10	(233)	3.34	(96)	34	2.07	1.057	5.48	76.3	19.0
38	7.24	(239)	2.97	(98)	39	2.07	1.057	5.48	76.7	18.9
39	8.33	(282)	3.31	(112)	40	2.07	1.057	5.48	79.2	18.2
40	5.38	(164)	2.07	(63)	36	2.07	1.057	5.48	81.8	24.7
41	4.67	(158)	1.80	(61)	40	2.07	1.057	5.48	81.4	24.9
42	14.38	(292)	5.42	(110)	24	2.07	1.057	5.48	83.4	19.2
43	17.26	(292)	6.44	(109)	20	2.07	1.057	5.48	84.2	19.5
44	4.91	(137)	1.79	(50)	33	2.07	1.057	5.48	86.1	28.8
45	9.49	(289)	3.38	(103)	36	2.07	1.057	5.48	88.1	20.8
46	13.46	(262)	4.73	(92)	23	2.07	1.057	5.48	89.5	22.2
47	7.33	(217)	2.53	(75)	35	2.07	1.057	5.48	90.9	24.8
48	5.98	(182)	2.00	(61)	36	2.07	1.057	5.48	93.7	28.2
49	12.55	(308)	4.20	(103)	29	2.07	1.057	5.48	93.9	22.0
50	5.82	(197)	1.92	(65)	40	2.07	1.057	5.48	95.2	27.7

Date, Time: 01-15-1991 09:35:42 Filename: COWLITZ2.FTZ
Lab# C3 Field# V450 Cowlitz Fm., Stillwater, Washington Vance 12/19/89
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
51	14.32	(206)	4.59	(66)	17	2.07	1.057	5.48	98.0	28.2
52	7.09	(210)	2.26	(67)	35	2.07	1.057	5.48	98.4	28.1
53	6.83	(185)	2.14	(58)	32	2.07	1.057	5.48	100.1	30.6
54	13.04	(342)	4.08	(107)	31	2.07	1.057	5.48	100.3	22.9
55	5.48	(139)	1.26	(32)	30	2.07	1.057	5.48	136.0	53.8
56	12.46	(253)	2.81	(57)	24	2.07	1.057	5.48	138.9	41.4
57	11.05	(271)	2.40	(59)	29	2.07	1.057	5.48	143.7	42.0
58	17.20	(291)	3.01	(51)	20	2.07	1.057	5.48	178.0	54.9
59	15.60	(330)	2.55	(54)	25	2.07	1.057	5.48	190.5	56.9
60	15.83	(375)	1.98	(47)	28	2.07	1.057	5.48	247.6	77.8

Date, Time: 01-15-1991 09:35:42 Filename: COWLITZ2.FTZ
Lab# C3 Field# V450 Cowlitz Fm., Stillwater, Washington Vance 12/19/89
Number of grains = 60
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	3.72	(85)	3.37	(77)	201	47	34.8	11.1	100.0	34.8	11.1
2	4.36	(166)	3.31	(126)	197	37	41.5	10.1	36.9	39.0	7.7
3	7.26	(215)	5.44	(161)	324	54	42.1	9.1	57.4	40.4	6.1
4	7.31	(198)	5.47	(148)	326	56	42.2	9.5	74.6	40.9	5.3
5	7.73	(157)	5.57	(113)	331	65	43.8	11.1	82.9	41.4	4.9
6	3.81	(158)	2.68	(111)	159	32	44.9	11.4	87.0	41.9	4.7
7	4.20	(142)	2.93	(99)	174	36	45.2	12.1	90.7	42.3	4.5
8	12.02	(295)	8.15	(200)	486	74	46.5	8.9	88.6	43.1	4.2
9	8.79	(223)	5.95	(151)	354	61	46.5	10.1	90.3	43.6	4.1
10	6.95	(241)	4.70	(163)	280	46	46.6	9.8	92.1	43.9	4.0
11	12.83	(228)	8.16	(145)	486	85	49.5	10.9	89.0	44.5	3.9
13	9.34	(158)	5.85	(99)	349	73	50.3	13.2	88.1	44.8	3.8
12	7.76	(315)	4.83	(196)	287	44	50.6	9.6	82.3	45.5	3.7
14	13.50	(217)	8.03	(129)	478	88	53.0	12.1	75.1	46.0	3.7
15	13.81	(257)	7.84	(146)	467	81	55.4	11.9	57.8	46.7	3.7
17	3.69	(131)	2.08	(74)	124	30	55.8	16.5	53.8	47.0	3.7
16	11.52	(273)	6.50	(154)	387	66	55.8	11.7	41.0	47.6	3.7
18	10.34	(315)	5.78	(176)	344	55	56.4	11.0	28.9	48.2	3.6
20	12.17	(309)	6.74	(171)	401	65	56.9	11.3	20.5	48.8	3.6
19	7.93	(161)	4.38	(89)	261	57	57.0	15.4	19.6	49.0	3.6
21	10.07	(264)	5.49	(144)	327	57	57.7	12.4	15.2	49.5	3.6
22	5.88	(199)	3.13	(106)	187	38	59.1	14.6	12.3	49.8	3.6
23	1.44	(77)	0.73	(39)	44	14	62.2	24.7	12.1	50.0	3.6
24	4.48	(220)	2.26	(111)	135	27	62.4	14.9	7.3	50.4	3.6
25	11.48	(233)	5.71	(116)	340	66	63.2	14.8	3.9	50.9	3.6
26	5.59	(189)	2.69	(91)	160	35	65.4	17.1	2.1	51.3	3.6
27	9.61	(244)	4.61	(117)	275	53	65.6	15.2	0.9	51.7	3.6
30	10.71	(290)	4.95	(134)	295	53	68.1	14.7	0.2	52.4	3.6
28	7.30	(210)	3.37	(97)	201	42	68.1	17.1	0.1	52.8	3.6
29	5.20	(176)	2.39	(81)	143	33	68.4	18.7	0.0	53.1	3.6
31	16.89	(300)	7.49	(133)	446	81	71.0	15.3	0.0	53.7	3.7
32	5.70	(193)	2.51	(85)	150	33	71.4	19.0	0.0	54.1	3.7
33	5.25	(191)	2.31	(84)	138	31	71.5	19.1	0.0	54.5	3.7
34	10.64	(216)	4.58	(93)	273	59	73.1	18.6	0.0	54.9	3.7
35	4.93	(200)	2.07	(84)	123	28	74.9	19.9	0.0	55.3	3.7
36	9.51	(177)	3.98	(74)	237	57	75.2	21.2	0.0	55.6	3.7
37	8.10	(233)	3.34	(96)	199	42	76.3	19.0	0.0	56.1	3.7
38	7.24	(239)	2.97	(98)	177	37	76.7	18.9	0.0	56.5	3.7
39	8.33	(282)	3.31	(112)	197	39	79.2	18.2	0.0	57.1	3.8
41	4.67	(158)	1.80	(61)	107	28	81.4	24.9	0.0	57.4	3.8
40	5.38	(164)	2.07	(63)	123	32	81.8	24.7	0.0	57.7	3.8
42	14.38	(292)	5.42	(110)	323	64	83.4	19.2	0.0	58.3	3.8
43	17.26	(292)	6.44	(109)	384	76	84.2	19.5	0.0	58.9	3.8
44	4.91	(137)	1.79	(50)	107	31	86.1	28.8	0.0	59.1	3.8
45	9.49	(289)	3.38	(103)	201	41	88.1	20.8	0.0	59.7	3.9
46	13.46	(262)	4.73	(92)	282	61	89.5	22.2	0.0	60.2	3.9
47	7.33	(217)	2.53	(75)	151	36	90.9	24.8	0.0	60.7	3.9
48	5.98	(182)	2.00	(61)	119	31	93.7	28.2	0.0	61.1	3.9
49	12.55	(308)	4.20	(103)	250	51	93.9	22.0	0.0	61.7	4.0
50	5.82	(197)	1.92	(65)	114	29	95.2	27.7	0.0	62.1	4.0

Date, Time: 01-15-1991 09:35:42 Filename: COWLITZ2.FTZ
Lab# C3 Field# V450 Cowlitz Fm., Stillwater, Washington Vance 12/19/89
Number of grains = 60
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		$P(\chi^2)$ (%)	Sum age ± 2s (Ma)	
51	14.32	(206)	4.59	(66)	273	69	98.0	28.2	0.0	62.5	4.0
52	7.09	(210)	2.26	(67)	135	34	98.4	28.1	0.0	62.9	4.0
53	6.83	(185)	2.14	(58)	128	34	100.1	30.6	0.0	63.3	4.0
54	13.04	(342)	4.08	(107)	243	49	100.3	22.9	0.0	64.0	4.1
55	5.48	(139)	1.26	(32)	75	27	136.0	53.8	0.0	64.4	4.1
56	12.46	(253)	2.81	(57)	167	45	138.9	41.4	0.0	65.1	4.1
57	11.05	(271)	2.40	(59)	143	38	143.7	42.0	0.0	65.9	4.2
58	17.20	(291)	3.01	(51)	180	51	178.0	54.9	0.0	66.9	4.2
59	15.60	(330)	2.55	(54)	152	42	190.5	56.9	0.0	68.0	4.3
60	15.83	(375)	1.98	(47)	118	35	247.6	77.8	0.0	69.4	4.4
POOLED	8.09	(13477)	3.67	(6113)	219	13			0.0	69.4	4.4
MEAN AGE (using grain ratios)										78.2	10.9

Date, Time: 01-15-1991 09:36:02 Filename: COWLITZ1.FTZ
Lab# C4, Field# V403 Cowlitz Fm., Tillamook, Oregon Vance 11/16/88
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	2.75	(72)	3.09	(81)	31	2.05	1.050	4.10	27.9	9.1
2	9.13	(170)	9.03	(168)	22	2.05	1.050	4.10	31.7	7.0
3	2.65	(112)	2.25	(95)	50	2.05	1.050	4.10	36.9	10.4
4	7.31	(198)	6.13	(166)	32	2.05	1.050	4.10	37.4	8.0
5	6.89	(169)	5.42	(133)	29	2.05	1.050	4.10	39.8	9.4
6	3.94	(130)	3.64	(120)	39	2.05	1.050	4.10	34.0	8.7
7	14.56	(234)	11.38	(183)	19	2.05	1.050	4.10	40.1	8.1
8	13.77	(268)	10.59	(206)	23	2.05	1.050	4.10	40.8	7.7
9	14.60	(247)	11.17	(189)	20	2.05	1.050	4.10	40.9	8.1
10	14.58	(333)	11.12	(254)	27	2.05	1.050	4.10	41.1	7.0
11	11.06	(290)	8.24	(216)	31	2.05	1.050	4.10	42.1	7.8
12	6.50	(99)	4.66	(71)	18	2.05	1.050	4.10	43.7	13.7
13	12.15	(298)	8.56	(210)	29	2.05	1.050	4.10	44.4	8.2
14	14.30	(254)	10.08	(179)	21	2.05	1.050	4.10	44.4	8.9
15	4.21	(121)	2.89	(83)	34	2.05	1.050	4.10	45.6	13.1
16	7.62	(187)	5.22	(128)	29	2.05	1.050	4.10	45.7	10.7
17	16.66	(296)	11.37	(202)	21	2.05	1.050	4.10	45.9	8.6
18	9.54	(226)	6.37	(151)	28	2.05	1.050	4.10	46.9	10.0
19	9.86	(267)	6.54	(177)	32	2.05	1.050	4.10	47.2	9.4
20	9.40	(159)	6.09	(103)	20	2.05	1.050	4.10	48.3	12.4
21	9.80	(199)	6.21	(126)	24	2.05	1.050	4.10	49.4	11.4
22	9.52	(282)	6.01	(178)	35	2.05	1.050	4.10	49.6	9.7
23	13.46	(296)	8.46	(186)	26	2.05	1.050	4.10	49.8	9.5
24	13.46	(296)	8.23	(181)	26	2.05	1.050	4.10	51.2	9.9
25	8.67	(198)	5.25	(120)	27	2.05	1.050	4.10	51.6	12.1
26	9.58	(227)	5.66	(134)	28	2.05	1.050	4.10	53.0	11.8
27	10.86	(248)	6.09	(139)	27	2.05	1.050	4.10	55.8	12.0
28	15.32	(324)	8.37	(177)	25	2.05	1.050	4.10	57.3	11.0
29	15.18	(321)	8.18	(173)	25	2.05	1.050	4.10	58.0	11.2
30	12.41	(231)	6.66	(124)	22	2.05	1.050	4.10	58.3	13.2
31	10.64	(288)	5.69	(154)	32	2.05	1.050	4.10	58.5	11.9
32	8.46	(186)	4.50	(99)	26	2.05	1.050	4.10	58.8	14.8
33	12.26	(332)	6.46	(175)	32	2.05	1.050	4.10	59.3	11.4
34	5.84	(163)	3.08	(86)	33	2.05	1.050	4.10	59.3	16.0
35	9.16	(186)	4.83	(98)	24	2.05	1.050	4.10	59.4	15.0
36	6.77	(189)	3.47	(97)	33	2.05	1.050	4.10	60.9	15.4
37	10.72	(254)	5.49	(130)	28	2.05	1.050	4.10	61.1	13.4
38	6.71	(159)	3.38	(80)	28	2.05	1.050	4.10	62.2	17.2
39	9.46	(192)	4.68	(95)	24	2.05	1.050	4.10	63.2	16.1
40	11.56	(176)	5.71	(87)	18	2.05	1.050	4.10	63.3	16.8
41	6.25	(148)	3.00	(71)	28	2.05	1.050	4.10	65.2	19.0
42	12.49	(169)	5.84	(79)	16	2.05	1.050	4.10	66.9	18.4
43	11.07	(309)	5.12	(143)	33	2.05	1.050	4.10	67.5	13.9
44	11.43	(203)	5.07	(90)	21	2.05	1.050	4.10	70.5	18.1
45	8.72	(177)	3.84	(78)	24	2.05	1.050	4.10	70.9	19.5
46	12.69	(247)	5.55	(108)	23	2.05	1.050	4.10	71.5	16.7
47	8.09	(260)	3.48	(112)	38	2.05	1.050	4.10	72.5	16.7
48	8.55	(246)	3.65	(105)	34	2.05	1.050	4.10	73.2	17.3
49	8.87	(180)	3.45	(70)	24	2.05	1.050	4.10	80.3	22.9
50	7.20	(134)	2.79	(52)	22	2.05	1.050	4.10	80.5	26.5

Date, Time: 01-15-1991 09:36:02 Filename: COWLITZ1.FTZ
Lab# C4, Field# V403 Cowlitz Fm., Tillamook, Oregon Vance 11/16/88
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
51	25.78	(349)	9.53	(129)	16	2.05	1.050	4.10	84.5	17.7
52	6.54	(155)	2.41	(57)	28	2.05	1.050	4.10	84.9	26.5
53	14.13	(239)	4.96	(84)	20	2.05	1.050	4.10	88.8	22.8
54	9.97	(253)	3.19	(81)	30	2.05	1.050	4.10	97.4	25.2
55	15.30	(246)	4.91	(79)	19	2.05	1.050	4.10	97.1	25.4
56	16.25	(330)	5.17	(105)	24	2.05	1.050	4.10	98.0	22.3
57	13.91	(200)	4.03	(58)	17	2.05	1.050	4.10	107.5	32.4
58	14.81	(376)	3.66	(93)	30	2.05	1.050	4.10	125.8	29.6
59	10.13	(257)	2.01	(51)	30	2.05	1.050	4.10	156.4	48.4
60	10.53	(196)	1.93	(36)	22	2.05	1.050	4.10	168.8	61.6

Date, Time: 01-15-1991 09:36:02 Filename: COWLITZ1.FTZ
Lab# C4, Field# V403 Cowlitz Fm., Tillamook, Oregon Vance 11/16/88
Number of grains = 60
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	2.75	(72)	3.09	(81)	185	42	27.9	9.1	100.0	27.9	9.1
2	9.13	(170)	9.03	(168)	542	86	31.7	7.0	50.6	30.5	5.6
6	3.94	(130)	3.64	(120)	218	41	34.0	8.7	62.8	31.6	4.8
3	2.65	(112)	2.25	(95)	135	28	36.9	10.4	59.0	32.7	4.5
4	7.31	(198)	6.13	(166)	368	59	37.4	8.0	54.2	33.9	4.0
5	6.89	(169)	5.42	(133)	325	58	39.8	9.4	45.9	35.0	3.8
7	14.56	(234)	11.38	(183)	683	105	40.1	8.1	40.2	35.9	3.5
8	13.77	(268)	10.59	(206)	635	92	40.8	7.7	35.9	36.8	3.3
9	14.60	(247)	11.17	(189)	670	101	40.9	8.1	36.3	37.4	3.2
10	14.58	(333)	11.12	(254)	667	88	41.1	7.0	36.3	38.0	3.0
11	11.06	(290)	8.24	(216)	494	70	42.1	7.8	35.8	38.5	2.9
12	6.50	(99)	4.66	(71)	280	67	43.7	13.7	39.1	38.7	2.9
14	14.30	(254)	10.08	(179)	605	94	44.4	8.9	33.2	39.2	2.8
13	12.15	(298)	8.56	(210)	514	74	44.4	8.2	28.6	39.6	2.8
15	4.21	(121)	2.89	(83)	173	39	45.6	13.1	29.5	39.9	2.7
16	7.62	(187)	5.22	(128)	313	57	45.7	10.7	27.9	40.2	2.7
17	16.66	(296)	11.37	(202)	682	100	45.9	8.6	23.4	40.6	2.7
18	9.54	(226)	6.37	(151)	382	64	46.9	10.0	20.5	40.9	2.6
19	9.86	(267)	6.54	(177)	392	61	47.2	9.4	16.9	41.3	2.6
20	9.40	(159)	6.09	(103)	365	74	48.3	12.4	15.7	41.5	2.6
21	9.80	(199)	6.21	(126)	372	68	49.4	11.4	12.4	41.8	2.6
22	9.52	(282)	6.01	(178)	361	56	49.6	9.7	8.3	42.2	2.6
23	13.46	(296)	8.46	(186)	507	77	49.8	9.5	5.6	42.6	2.6
24	13.46	(296)	8.23	(181)	494	76	51.2	9.9	3.2	43.0	2.5
25	8.67	(198)	5.25	(120)	315	59	51.6	12.1	2.4	43.3	2.5
26	9.58	(227)	5.66	(134)	339	60	53.0	11.8	1.4	43.6	2.5
27	10.86	(248)	6.09	(139)	365	64	55.8	12.0	0.5	44.0	2.5
28	15.32	(324)	8.37	(177)	502	78	57.3	11.0	0.1	44.6	2.5
29	15.18	(321)	8.18	(173)	491	77	58.0	11.2	0.0	45.1	2.5
30	12.41	(231)	6.66	(124)	400	74	58.3	13.2	0.0	45.4	2.5
31	10.64	(288)	5.69	(154)	341	57	58.5	11.9	0.0	45.9	2.5
32	8.46	(186)	4.50	(99)	270	55	58.8	14.8	0.0	46.1	2.5
34	5.84	(163)	3.08	(86)	185	41	59.3	16.0	0.0	46.3	2.5
33	12.26	(332)	6.46	(175)	388	61	59.3	11.4	0.0	46.8	2.6
35	9.16	(186)	4.83	(98)	290	60	59.4	15.0	0.0	47.0	2.6
36	6.77	(189)	3.47	(97)	208	43	60.9	15.4	0.0	47.3	2.6
37	10.72	(254)	5.49	(130)	329	59	61.1	13.4	0.0	47.6	2.6
38	6.71	(159)	3.38	(80)	203	46	62.2	17.2	0.0	47.8	2.6
39	9.46	(192)	4.68	(95)	281	59	63.2	16.1	0.0	48.1	2.6
40	11.56	(176)	5.71	(87)	343	75	63.3	16.8	0.0	48.3	2.6
41	6.25	(148)	3.00	(71)	180	43	65.2	19.0	0.0	48.5	2.6
42	12.49	(169)	5.84	(79)	350	80	66.9	18.4	0.0	48.7	2.6
43	11.07	(309)	5.12	(143)	307	53	67.5	13.9	0.0	49.2	2.6
44	11.43	(203)	5.07	(90)	304	65	70.5	18.1	0.0	49.5	2.6
45	8.72	(177)	3.84	(78)	230	53	70.9	19.5	0.0	49.8	2.6
46	12.69	(247)	5.55	(108)	333	66	71.5	16.7	0.0	50.1	2.6
47	8.09	(260)	3.48	(112)	209	40	72.5	16.7	0.0	50.5	2.6
48	8.55	(246)	3.65	(105)	219	44	73.2	17.3	0.0	50.9	2.6
49	8.87	(180)	3.45	(70)	207	50	80.3	22.9	0.0	51.2	2.6
50	7.20	(134)	2.79	(52)	168	47	80.5	26.5	0.0	51.4	2.6

Date, Time: 01-15-1991 09:36:02 Filename: COWLITZ1.FTZ
Lab# C4, Field# V403 Cowlitz Fm., Tillamook, Oregon Vance 11/16/88
Number of grains = 60
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		$P(\chi^2)$ (%)	Sum age ± 2s (Ma)	
51	25.78	(349)	9.53	(129)	572	103	84.5	17.7	0.0	52.1	2.7
52	6.54	(155)	2.41	(57)	144	39	84.9	26.5	0.0	52.3	2.7
53	14.13	(239)	4.96	(84)	298	66	88.8	22.8	0.0	52.8	2.7
55	15.30	(246)	4.91	(79)	295	67	97.1	25.4	0.0	53.3	2.7
54	9.97	(253)	3.19	(81)	191	43	97.4	25.2	0.0	53.8	2.7
56	16.25	(330)	5.17	(105)	310	62	98.0	22.3	0.0	54.4	2.8
57	13.91	(200)	4.03	(58)	242	64	107.5	32.4	0.0	54.9	2.8
58	14.81	(376)	3.66	(93)	220	46	125.8	29.6	0.0	55.8	2.8
59	10.13	(257)	2.01	(51)	121	34	156.4	48.4	0.0	56.5	2.8
60	10.53	(196)	1.93	(36)	116	39	168.8	61.6	0.0	57.0	2.9
POOLED	10.03	(13551)	5.50	(7435)	330	16			0.0	57.0	2.9
MEAN AGE (using grain ratios)										63.3	7.5

Date, Time: 03-10-1991 21:15:04 Filename: V335.FTZ
Lab# C5 Field# V335 Skookumchuck Fm, tuff from Centralia coal pit Vance 10/85
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	5.11	(186)	5.00	(182)	43	2.11	1.080	4.56	32.9	7.0
2	4.66	(142)	4.47	(136)	36	2.11	1.080	4.56	33.7	8.2
3	4.14	(168)	3.87	(157)	48	2.11	1.080	4.56	34.5	7.8
4	4.39	(156)	4.05	(144)	42	2.11	1.080	4.56	34.9	8.2
5	5.62	(176)	5.08	(159)	37	2.11	1.080	4.56	35.7	8.0
6	3.87	(121)	3.45	(108)	37	2.11	1.080	4.56	36.1	9.7
7	5.21	(141)	4.51	(122)	32	2.11	1.080	4.56	37.2	9.4
8	4.17	(148)	3.52	(125)	42	2.11	1.080	4.56	38.2	9.4
9	4.14	(140)	3.46	(117)	40	2.11	1.080	4.56	38.6	9.8
10	4.63	(188)	3.79	(154)	48	2.11	1.080	4.56	39.3	8.7
11	5.87	(149)	4.73	(120)	30	2.11	1.080	4.56	40.0	10.0
12	4.41	(179)	3.55	(144)	48	2.11	1.080	4.56	40.1	9.2
13	4.56	(162)	3.66	(130)	42	2.11	1.080	4.56	40.2	9.6
14	5.44	(161)	4.29	(127)	35	2.11	1.080	4.56	40.8	9.9
15	5.18	(184)	3.91	(139)	42	2.11	1.080	4.56	42.6	9.8
16	6.14	(187)	4.66	(142)	36	2.11	1.080	4.56	42.4	9.6
17	5.06	(197)	3.78	(147)	46	2.11	1.080	4.56	43.2	9.6
18	6.34	(161)	4.65	(118)	30	2.11	1.080	4.56	43.9	10.8
19	4.76	(141)	3.48	(103)	35	2.11	1.080	4.56	44.1	11.6
20	7.85	(206)	5.00	(131)	31	2.11	1.080	4.56	50.6	11.5

Date, Time: 03-10-1991 21:15:04 Filename: V335.FTZ
Lab# C5 Field# V335 Skookumchuck Fm, tuff from Centralia coal pit Vance 10/85
Number of grains = 20
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	5.11	(186)	5.00	(182)	292	45	32.9	7.0	100.0	32.9	7.0
2	4.66	(142)	4.47	(136)	260	46	33.7	8.2	89.3	33.3	5.4
3	4.14	(168)	3.87	(157)	225	37	34.5	7.8	95.5	33.7	4.6
4	4.39	(156)	4.05	(144)	236	41	34.9	8.2	98.2	34.0	4.1
5	5.62	(176)	5.08	(159)	296	49	35.7	8.0	98.8	34.3	3.8
6	3.87	(121)	3.45	(108)	201	40	36.1	9.7	99.3	34.5	3.6
7	5.21	(141)	4.51	(122)	263	49	37.2	9.4	99.2	34.9	3.4
8	4.17	(148)	3.52	(125)	205	38	38.2	9.4	98.9	35.2	3.3
9	4.14	(140)	3.46	(117)	202	38	38.6	9.8	98.7	35.5	3.2
10	4.63	(188)	3.79	(154)	221	37	39.3	8.7	98.0	35.9	3.1
11	5.87	(149)	4.73	(120)	276	52	40.0	10.0	97.5	36.3	3.0
12	4.41	(179)	3.55	(144)	207	36	40.1	9.2	97.1	36.6	3.0
13	4.56	(162)	3.66	(130)	213	39	40.2	9.6	97.1	36.9	2.9
14	5.44	(161)	4.29	(127)	250	46	40.8	9.9	96.9	37.1	2.9
16	6.14	(187)	4.66	(142)	272	47	42.4	9.6	94.9	37.5	2.8
15	5.18	(184)	3.91	(139)	228	40	42.6	9.8	93.0	37.8	2.8
17	5.06	(197)	3.78	(147)	220	38	43.2	9.6	90.3	38.1	2.8
18	6.34	(161)	4.65	(118)	271	51	43.9	10.8	87.8	38.4	2.7
19	4.76	(141)	3.48	(103)	203	41	44.1	11.6	86.4	38.6	2.7
20	7.85	(206)	5.00	(131)	291	53	50.6	11.5	57.2	39.2	2.7
POOLED	4.99	(3293)	4.10	(2705)	239	14			57.2	39.2	2.7
MEAN AGE (using grain ratios)										39.5	2.6

Date, Time: 01-15-1991 09:36:14 Filename: FCTFALL.FTZ
Lab# F1 Pooled results for Fish Canyon Tuff #1 - #8, all counted by Vance
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	4.43	(135)	5.88	(179)	36	1.91	0.978	5.44	22.0	5.2
2	3.57	(148)	4.68	(194)	49	1.91	0.978	5.44	22.3	5.0
3	3.46	(123)	4.53	(161)	42	1.91	0.978	5.44	22.3	5.5
4	6.21	(184)	7.97	(236)	35	1.91	0.978	5.44	22.8	4.6
5	3.97	(121)	4.96	(151)	36	1.91	0.978	5.44	23.4	5.9
6	5.88	(179)	7.06	(215)	36	1.91	0.978	5.44	24.3	5.1
7	5.02	(170)	5.85	(198)	40	1.91	0.978	5.44	25.1	5.4
8	3.68	(140)	4.02	(153)	45	1.91	0.978	5.44	26.7	6.4
9	6.70	(204)	7.32	(223)	36	1.91	0.978	5.44	26.7	5.4
10	7.77	(276)	8.39	(298)	42	1.91	0.978	5.44	27.1	4.8
11	7.61	(206)	8.20	(222)	32	1.91	0.978	5.44	27.1	5.4
12	3.80	(180)	4.01	(190)	56	1.91	0.978	5.44	27.7	5.9
13	5.06	(154)	5.15	(157)	36	1.91	0.978	5.44	28.6	6.7
14	5.55	(169)	5.58	(170)	36	1.91	0.978	5.44	29.0	6.5
15	6.67	(254)	6.67	(254)	45	1.91	0.978	5.44	29.2	5.4
16	7.84	(199)	7.80	(198)	30	1.91	0.978	5.44	29.3	6.1
17	4.55	(154)	4.46	(151)	40	1.91	0.978	5.44	29.8	7.0
18	6.33	(241)	6.07	(231)	45	1.91	0.978	5.44	30.5	5.8
19	7.16	(212)	6.05	(179)	35	1.91	0.978	5.44	34.6	7.3
20	8.04	(204)	6.74	(171)	30	1.91	0.978	5.44	34.8	7.5
21	7.49	(114)	6.83	(104)	18	1.85	0.945	4.42	30.9	8.5
22	7.09	(96)	7.68	(104)	16	1.85	0.945	4.42	26.1	7.5
23	5.57	(99)	6.19	(110)	21	1.85	0.945	4.42	25.4	7.1
24	7.29	(111)	7.55	(115)	18	1.85	0.945	4.42	27.2	7.3
25	8.81	(149)	7.27	(123)	20	1.85	0.945	4.42	34.2	8.5
26	7.04	(149)	7.52	(159)	25	1.85	0.945	4.42	26.4	6.1
27	2.78	(148)	4.11	(219)	63	2.03	1.040	5.30	21.0	4.6
28	4.78	(178)	6.29	(234)	44	2.03	1.040	5.30	23.6	4.9
29	6.71	(227)	8.07	(273)	40	2.03	1.040	5.30	25.8	4.8
30	7.24	(196)	8.64	(234)	32	2.03	1.040	5.30	26.0	5.2
31	5.66	(225)	6.61	(263)	47	2.03	1.040	5.30	26.6	5.0
32	5.86	(218)	6.39	(238)	44	2.03	1.040	5.30	28.4	5.5
33	7.95	(249)	8.08	(253)	37	2.03	1.040	5.30	30.6	5.7
34	6.97	(236)	6.74	(228)	40	2.03	1.040	5.30	32.1	6.2
35	7.35	(261)	5.85	(208)	42	2.03	1.040	5.30	38.9	7.5
36	5.44	(175)	4.26	(137)	38	2.03	1.040	5.30	39.6	9.3
37	6.61	(179)	9.38	(254)	32	2.07	1.060	5.86	22.3	4.5
38	6.48	(137)	8.98	(190)	25	2.07	1.060	5.86	22.8	5.3
39	7.61	(161)	9.69	(205)	25	2.07	1.060	5.86	24.9	5.4
40	6.22	(142)	7.62	(174)	27	2.07	1.060	5.86	25.8	6.0
41	5.83	(148)	6.86	(174)	30	2.07	1.060	5.86	26.9	6.2
42	6.74	(171)	7.53	(191)	30	2.07	1.060	5.86	28.3	6.2
43	7.26	(172)	7.94	(188)	28	2.07	1.060	5.86	29.0	6.3
44	8.75	(148)	9.52	(161)	20	2.07	1.060	5.86	29.1	6.8
45	8.78	(208)	9.54	(226)	28	2.07	1.060	5.86	29.1	5.9
46	7.93	(161)	8.37	(170)	24	2.07	1.060	5.86	30.0	6.8
47	5.80	(157)	6.09	(165)	32	2.07	1.060	5.86	30.1	6.9
48	6.83	(185)	7.06	(191)	32	2.07	1.060	5.86	30.7	6.6
49	8.01	(244)	8.11	(247)	36	2.07	1.060	5.86	31.3	5.9
50	8.09	(219)	8.13	(220)	32	2.07	1.060	5.86	31.5	6.3

Date, Time: 01-15-1991 09:36:14 Filename: FCTFALL.FTZ
Lab# F1 Pooled results for Fish Canyon Tuff #1 - #8, all counted by Vance
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
51	6.78	(172)	6.58	(167)	30	2.07	1.060	5.86	32.6	7.3
52	9.81	(166)	9.46	(160)	20	2.07	1.060	5.86	32.8	7.5
53	8.22	(167)	7.88	(160)	24	2.07	1.060	5.86	33.0	7.6
54	7.84	(199)	7.29	(185)	30	2.07	1.060	5.86	34.0	7.2
55	8.59	(218)	7.92	(201)	30	2.07	1.060	5.86	34.3	7.0
56	5.55	(155)	4.69	(131)	33	2.07	1.060	5.86	37.4	9.1
57	5.54	(225)	7.49	(304)	48	2.03	1.040	5.92	23.0	4.3
58	6.89	(233)	8.45	(286)	40	2.03	1.040	5.92	25.3	4.7
59	5.83	(207)	5.40	(192)	42	2.03	1.040	5.92	33.5	7.0
60	6.33	(225)	9.40	(334)	42	2.03	1.040	5.92	20.9	3.8
61	6.28	(223)	7.37	(262)	42	2.03	1.040	5.92	26.4	5.1
62	6.60	(201)	8.11	(247)	36	2.03	1.040	5.92	25.3	5.0
63	6.61	(179)	9.38	(254)	32	2.08	1.060	5.86	22.3	4.5
64	6.48	(137)	8.98	(190)	25	2.08	1.060	5.86	22.8	5.3
65	7.61	(161)	9.69	(205)	25	2.08	1.060	5.86	24.9	5.4
66	6.22	(142)	7.62	(174)	27	2.08	1.060	5.86	25.8	6.0
67	5.83	(148)	6.86	(174)	30	2.08	1.060	5.86	26.9	6.2
68	6.74	(171)	7.53	(191)	30	2.08	1.060	5.86	28.3	6.2
69	7.26	(172)	7.94	(188)	28	2.08	1.060	5.86	29.0	6.3
70	8.75	(148)	9.52	(161)	20	2.08	1.060	5.86	29.1	6.8
71	8.78	(208)	9.54	(226)	28	2.08	1.060	5.86	29.1	5.9
72	7.93	(161)	8.37	(170)	24	2.08	1.060	5.86	30.0	6.8
73	5.80	(157)	6.09	(165)	32	2.08	1.060	5.86	30.1	6.9
74	6.83	(185)	7.06	(191)	32	2.08	1.060	5.86	30.7	6.6
75	8.01	(244)	8.11	(247)	36	2.08	1.060	5.86	31.3	5.9
76	8.09	(219)	8.13	(220)	32	2.08	1.060	5.86	31.5	6.3
77	6.78	(172)	6.58	(167)	30	2.08	1.060	5.86	32.6	7.3
78	9.81	(166)	9.46	(160)	20	2.08	1.060	5.86	32.8	7.5
79	8.22	(167)	7.88	(160)	24	2.08	1.060	5.86	33.0	7.6
80	7.84	(199)	7.29	(185)	30	2.08	1.060	5.86	34.0	7.2
81	8.59	(218)	7.92	(201)	30	2.08	1.060	5.86	34.3	7.0
82	5.55	(155)	4.69	(131)	33	2.08	1.060	5.86	37.4	9.1
83	2.78	(148)	4.11	(219)	63	2.03	1.040	5.30	21.0	4.6
84	4.78	(178)	6.29	(234)	44	2.03	1.040	5.30	23.6	4.9
85	6.71	(227)	8.07	(273)	40	2.03	1.040	5.30	25.8	4.8
86	7.24	(196)	8.64	(234)	32	2.03	1.040	5.30	26.0	5.2
87	5.66	(225)	6.61	(263)	47	2.03	1.040	5.30	26.6	5.0
88	5.86	(218)	6.39	(238)	44	2.03	1.040	5.30	28.4	5.5
89	7.95	(249)	8.08	(253)	37	2.03	1.040	5.30	30.6	5.7
90	6.97	(236)	6.74	(228)	40	2.03	1.040	5.30	32.1	6.2
91	7.35	(261)	5.85	(208)	42	2.03	1.040	5.30	38.9	7.5
92	5.44	(175)	4.26	(137)	38	2.03	1.040	5.30	39.6	9.3
93	8.44	(250)	10.47	(310)	35	1.83	0.935	5.30	22.5	4.0
94	6.18	(183)	7.26	(215)	35	1.83	0.935	5.30	23.8	4.9
95	9.97	(194)	9.92	(193)	23	1.83	0.935	5.30	28.1	5.9
96	7.76	(210)	7.65	(207)	32	1.83	0.935	5.30	28.3	5.7
97	6.64	(191)	6.36	(183)	34	1.83	0.935	5.30	29.1	6.2
98	9.22	(273)	8.44	(250)	35	1.83	0.935	5.30	30.5	5.6
99	5.28	(143)	4.54	(123)	32	1.83	0.935	5.30	32.4	8.2
100	5.73	(194)	4.82	(163)	40	1.83	0.935	5.30	33.2	7.3
101	6.97	(177)	5.24	(133)	30	1.83	0.935	5.30	37.1	8.7
102	7.57	(192)	5.52	(140)	30	1.83	0.935	5.30	38.2	8.7

Date, Time: 01-15-1991 09:36:14 Filename: FCTFALL.FTZ
Lab# F1 Pooled results for Fish Canyon Tuff #1 - #8, all counted by Vance
Number of grains = 102
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
60	6.33	(225)	9.40	(334)	570	71	20.9	3.8	100.0	20.9	3.8
83	2.78	(148)	4.11	(219)	249	36	21.0	4.6	35.9	21.0	3.1
27	2.78	(148)	4.11	(219)	249	36	21.0	4.6	55.5	21.0	2.7
1	4.43	(135)	5.88	(179)	378	60	22.0	5.2	63.4	21.2	2.5
2	3.57	(148)	4.68	(194)	301	46	22.3	5.0	69.1	21.4	2.3
37	6.61	(179)	9.38	(254)	558	77	22.3	4.5	73.3	21.5	2.2
63	6.61	(179)	9.38	(254)	555	77	22.3	4.5	76.2	21.7	2.0
3	3.46	(123)	4.53	(161)	292	49	22.3	5.5	82.1	21.7	2.0
93	8.44	(250)	10.47	(310)	705	88	22.5	4.0	77.2	21.8	1.9
4	6.21	(184)	7.97	(236)	513	72	22.8	4.6	80.8	21.9	1.8
38	6.48	(137)	8.98	(190)	534	84	22.8	5.3	84.6	22.0	1.8
64	6.48	(137)	8.98	(190)	531	83	22.8	5.3	87.4	22.1	1.8
57	5.54	(225)	7.49	(304)	454	59	23.0	4.3	89.3	22.2	1.7
5	3.97	(121)	4.96	(151)	319	55	23.4	5.9	90.7	22.2	1.7
28	4.78	(178)	6.29	(234)	381	54	23.6	4.9	92.0	22.3	1.7
84	4.78	(178)	6.29	(234)	381	54	23.6	4.9	93.1	22.4	1.7
94	6.18	(183)	7.26	(215)	489	72	23.8	4.9	90.0	22.5	1.7
6	5.88	(179)	7.06	(215)	455	67	24.3	5.1	88.5	22.6	1.6
39	7.61	(161)	9.69	(205)	576	87	24.9	5.4	89.4	22.7	1.6
65	7.61	(161)	9.69	(205)	573	87	24.9	5.4	90.2	22.8	1.6
7	5.02	(170)	5.85	(198)	377	57	25.1	5.4	87.4	22.9	1.6
62	6.60	(201)	8.11	(247)	491	69	25.3	5.0	87.0	23.0	1.6
58	6.89	(233)	8.45	(286)	512	68	25.3	4.7	86.1	23.1	1.6
23	5.57	(99)	6.19	(110)	412	81	25.4	7.1	84.4	23.2	1.6
29	6.71	(227)	8.07	(273)	489	65	25.8	4.8	82.8	23.3	1.6
85	6.71	(227)	8.07	(273)	489	65	25.8	4.8	81.5	23.4	1.6
40	6.22	(142)	7.62	(174)	453	74	25.8	6.0	82.6	23.5	1.6
66	6.22	(142)	7.62	(174)	450	73	25.8	6.0	83.7	23.5	1.6
86	7.24	(196)	8.64	(234)	523	74	26.0	5.2	83.1	23.6	1.6
30	7.24	(196)	8.64	(234)	524	74	26.0	5.2	82.7	23.7	1.6
22	7.09	(96)	7.68	(104)	511	103	26.1	7.5	81.3	23.7	1.6
61	6.28	(223)	7.37	(262)	447	61	26.4	5.1	79.6	23.8	1.6
26	7.04	(149)	7.52	(159)	500	82	26.4	6.1	74.3	23.9	1.6
31	5.66	(225)	6.61	(263)	401	54	26.6	5.0	72.8	24.0	1.6
87	5.66	(225)	6.61	(263)	401	54	26.6	5.0	71.7	24.1	1.6
9	6.70	(204)	7.32	(223)	472	68	26.7	5.4	66.5	24.2	1.5
8	3.68	(140)	4.02	(153)	259	44	26.7	6.4	64.8	24.2	1.5
41	5.83	(148)	6.86	(174)	407	66	26.9	6.2	65.9	24.3	1.5
67	5.83	(148)	6.86	(174)	405	66	26.9	6.2	67.0	24.3	1.5
10	7.77	(276)	8.39	(298)	540	69	27.1	4.8	58.5	24.4	1.5
11	7.61	(206)	8.20	(222)	528	76	27.1	5.4	53.7	24.5	1.5
24	7.29	(111)	7.55	(115)	502	96	27.2	7.3	51.0	24.5	1.5
12	3.80	(180)	4.01	(190)	258	40	27.7	5.9	45.9	24.6	1.5
95	9.97	(194)	9.92	(193)	668	102	28.1	5.9	34.0	24.7	1.5
96	7.76	(210)	7.65	(207)	515	77	28.3	5.7	22.6	24.7	1.5
42	6.74	(171)	7.53	(191)	447	70	28.3	6.2	22.6	24.8	1.5
68	6.74	(171)	7.53	(191)	445	69	28.3	6.2	22.7	24.9	1.5
88	5.86	(218)	6.39	(238)	387	54	28.4	5.5	21.1	25.0	1.5
32	5.86	(218)	6.39	(238)	387	54	28.4	5.5	19.8	25.0	1.5
13	5.06	(154)	5.15	(157)	332	56	28.6	6.7	17.2	25.1	1.5

Date, Time: 01-15-1991 09:36:14 Filename: FCTFALL.FTZ
Lab# F1 Pooled results for Fish Canyon Tuff #1 - #8, all counted by Vance
Number of grains = 102
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
43	7.26	(172)	7.94	(188)	472	74	29.0	6.3	16.9	25.2	1.5
69	7.26	(172)	7.94	(188)	469	74	29.0	6.3	16.6	25.2	1.5
14	5.55	(169)	5.58	(170)	359	59	29.0	6.5	13.6	25.3	1.5
44	8.75	(148)	9.52	(161)	565	95	29.1	6.8	13.7	25.3	1.5
70	8.75	(148)	9.52	(161)	563	95	29.1	6.8	13.8	25.4	1.6
97	6.64	(191)	6.36	(183)	429	67	29.1	6.2	9.1	25.4	1.6
45	8.78	(208)	9.54	(226)	567	82	29.1	5.9	8.8	25.5	1.6
71	8.78	(208)	9.54	(226)	564	82	29.1	5.9	8.5	25.6	1.6
15	6.67	(254)	6.67	(254)	430	59	29.2	5.4	6.0	25.6	1.6
16	7.84	(199)	7.80	(198)	502	76	29.3	6.1	4.6	25.7	1.6
17	4.55	(154)	4.46	(151)	287	49	29.8	7.0	3.7	25.8	1.6
46	7.93	(161)	8.37	(170)	498	82	30.0	6.8	3.6	25.8	1.6
72	7.93	(161)	8.37	(170)	495	81	30.0	6.8	3.6	25.9	1.6
47	5.80	(157)	6.09	(165)	362	60	30.1	6.9	3.5	25.9	1.6
73	5.80	(157)	6.09	(165)	360	60	30.1	6.9	3.4	26.0	1.6
18	6.33	(241)	6.07	(231)	391	56	30.5	5.8	2.0	26.0	1.6
98	9.22	(273)	8.44	(250)	569	78	30.5	5.6	0.7	26.1	1.6
89	7.95	(249)	8.08	(253)	489	67	30.6	5.7	0.6	26.2	1.6
33	7.95	(249)	8.08	(253)	490	67	30.6	5.7	0.4	26.3	1.6
48	6.83	(185)	7.06	(191)	419	65	30.7	6.6	0.4	26.3	1.6
74	6.83	(185)	7.06	(191)	417	65	30.7	6.6	0.4	26.4	1.6
21	7.49	(114)	6.83	(104)	454	91	30.9	8.5	0.3	26.4	1.6
49	8.01	(244)	8.11	(247)	482	68	31.3	5.9	0.2	26.5	1.6
75	8.01	(244)	8.11	(247)	480	67	31.3	5.9	0.2	26.6	1.6
50	8.09	(219)	8.13	(220)	483	71	31.5	6.3	0.2	26.6	1.6
76	8.09	(219)	8.13	(220)	481	71	31.5	6.3	0.1	26.7	1.6
90	6.97	(236)	6.74	(228)	408	58	32.1	6.2	0.1	26.8	1.6
34	6.97	(236)	6.74	(228)	408	58	32.1	6.2	0.1	26.8	1.6
99	5.28	(143)	4.54	(123)	306	58	32.4	8.2	0.0	26.9	1.6
51	6.78	(172)	6.58	(167)	391	65	32.6	7.3	0.0	26.9	1.6
77	6.78	(172)	6.58	(167)	389	64	32.6	7.3	0.0	27.0	1.6
52	9.81	(166)	9.46	(160)	562	95	32.8	7.5	0.0	27.1	1.6
78	9.81	(166)	9.46	(160)	559	94	32.8	7.5	0.0	27.1	1.6
53	8.22	(167)	7.88	(160)	468	79	33.0	7.6	0.0	27.2	1.6
79	8.22	(167)	7.88	(160)	466	79	33.0	7.6	0.0	27.2	1.6
100	5.73	(194)	4.82	(163)	324	54	33.2	7.3	0.0	27.3	1.6
59	5.83	(207)	5.40	(192)	327	51	33.5	7.0	0.0	27.3	1.6
54	7.84	(199)	7.29	(185)	433	69	34.0	7.2	0.0	27.4	1.6
80	7.84	(199)	7.29	(185)	431	68	34.0	7.2	0.0	27.5	1.6
25	8.81	(149)	7.27	(123)	483	90	34.2	8.5	0.0	27.5	1.6
55	8.59	(218)	7.92	(201)	471	72	34.3	7.0	0.0	27.6	1.6
81	8.59	(218)	7.92	(201)	468	72	34.3	7.0	0.0	27.7	1.6
19	7.16	(212)	6.05	(179)	389	62	34.6	7.3	0.0	27.7	1.6
20	8.04	(204)	6.74	(171)	434	70	34.8	7.5	0.0	27.8	1.6
101	6.97	(177)	5.24	(133)	353	64	37.1	8.7	0.0	27.9	1.6
56	5.55	(155)	4.69	(131)	279	51	37.4	9.1	0.0	27.9	1.6
82	5.55	(155)	4.69	(131)	277	51	37.4	9.1	0.0	28.0	1.6
102	7.57	(192)	5.52	(140)	372	66	38.2	8.7	0.0	28.1	1.6
91	7.35	(261)	5.85	(208)	355	53	38.9	7.5	0.0	28.2	1.6
35	7.35	(261)	5.85	(208)	355	53	38.9	7.5	0.0	28.3	1.6
92	5.44	(175)	4.26	(137)	258	46	39.6	9.3	0.0	28.4	1.6
36	5.44	(175)	4.26	(137)	258	46	39.6	9.3	0.0	28.4	1.7
POOLED	6.46	(18936)	6.63	(19445)	427	24			0.0	28.4	1.7
MEAN AGE (using grain ratios)										28.9	1.8

Date, Time: 01-15-1991 09:26:19 Filename: ARC88-16.FTZ
Lab# ZD38 Field# ARC88-16 Western Olympic Assem., SE of Forks, Vance 8/9/90
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	2.82	(86)	2.43	(74)	36	1.77	0.908	4.02	31.5	10.1
2	3.04	(90)	2.33	(69)	35	1.77	0.908	4.02	35.3	11.4
3	1.84	(59)	1.40	(45)	38	1.77	0.908	4.02	35.5	14.1
4	5.17	(153)	3.78	(112)	35	1.77	0.908	4.02	37.0	9.3
5	5.68	(173)	3.97	(121)	36	1.77	0.908	4.02	38.7	9.3
6	4.85	(123)	3.23	(82)	30	1.77	0.908	4.02	40.6	11.7
7	5.50	(186)	3.61	(122)	40	1.77	0.908	4.02	41.3	9.8
8	5.71	(140)	3.71	(91)	29	1.77	0.908	4.02	41.7	11.3
9	3.55	(144)	2.22	(90)	48	1.77	0.908	4.02	43.3	11.8
10	4.86	(144)	2.97	(88)	35	1.77	0.908	4.02	44.3	12.1
11	4.79	(154)	2.92	(94)	38	1.77	0.908	4.02	44.4	11.7
12	8.56	(210)	5.22	(128)	29	1.77	0.908	4.02	44.4	10.1
13	2.49	(82)	1.49	(49)	39	1.77	0.908	4.02	45.3	16.5
14	9.46	(240)	5.44	(138)	30	1.77	0.908	4.02	47.1	10.2
15	7.20	(256)	4.14	(147)	42	1.77	0.908	4.02	47.1	9.9
16	5.81	(167)	2.92	(84)	34	1.77	0.908	4.02	53.8	14.6
17	7.78	(237)	3.81	(116)	36	1.77	0.908	4.02	55.3	12.7
18	3.88	(115)	1.89	(56)	35	1.77	0.908	4.02	55.6	18.2
19	3.22	(120)	1.53	(57)	44	1.77	0.908	4.02	57.0	18.5
20	9.23	(281)	4.37	(133)	36	1.77	0.908	4.02	57.2	12.2
21	7.88	(240)	3.68	(112)	36	1.77	0.908	4.02	58.0	13.5
22	5.65	(172)	2.63	(80)	36	1.77	0.908	4.02	58.2	15.9
23	6.30	(192)	2.89	(88)	36	1.77	0.908	4.02	59.0	15.4
24	9.16	(186)	4.09	(83)	24	1.77	0.908	4.02	60.6	16.2
25	3.86	(147)	1.60	(61)	45	1.77	0.908	4.02	65.2	20.0
26	6.08	(216)	2.50	(89)	42	1.77	0.908	4.02	65.6	16.7
27	8.83	(224)	3.59	(91)	30	1.77	0.908	4.02	66.5	16.8
28	8.38	(248)	3.38	(100)	35	1.77	0.908	4.02	67.0	16.1
29	12.41	(315)	5.00	(127)	30	1.77	0.908	4.02	67.0	14.4
30	2.63	(89)	1.03	(35)	40	1.77	0.908	4.02	68.7	27.6
31	10.40	(264)	4.06	(103)	30	1.77	0.908	4.02	69.3	16.3
32	8.87	(255)	3.13	(90)	34	1.77	0.908	4.02	76.5	19.0
33	6.35	(188)	2.43	(72)	35	1.77	0.908	4.02	70.6	19.8
34	4.55	(127)	1.72	(48)	33	1.77	0.908	4.02	71.5	24.4
35	9.81	(274)	3.69	(103)	33	1.77	0.908	4.02	71.9	16.9
36	7.40	(169)	2.76	(63)	27	1.77	0.908	4.02	72.5	21.6
37	12.23	(207)	4.55	(77)	20	1.77	0.908	4.02	72.6	19.6
38	11.28	(229)	4.09	(83)	24	1.77	0.908	4.02	74.5	19.3
39	12.66	(225)	4.50	(80)	21	1.77	0.908	4.02	76.0	20.0
40	7.03	(214)	2.50	(76)	36	1.77	0.908	4.02	76.1	20.5
41	2.93	(99)	1.03	(35)	40	1.77	0.908	4.02	76.4	30.2
42	17.84	(317)	6.25	(111)	21	1.77	0.908	4.02	77.1	17.3
43	17.53	(267)	6.11	(93)	18	1.77	0.908	4.02	77.5	18.9
44	3.89	(112)	1.32	(38)	34	1.77	0.908	4.02	79.6	30.1
45	6.97	(165)	2.32	(55)	28	1.77	0.908	4.02	81.0	25.4
46	8.03	(163)	2.66	(54)	24	1.77	0.908	4.02	81.5	25.8
47	13.93	(271)	4.52	(88)	23	1.77	0.908	4.02	83.1	20.7
48	4.73	(160)	1.51	(51)	40	1.77	0.908	4.02	84.7	27.4
49	13.18	(223)	4.14	(70)	20	1.77	0.908	4.02	86.0	23.8
50	8.23	(195)	2.53	(60)	28	1.77	0.908	4.02	87.7	26.1

Date, Time: 01-15-1991 09:26:19 Filename: ARC88-16.FTZ
Lab# ZD38 Field# ARC88-16 Western Olympic Assem., SE of Forks, Vance 8/9/90
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
51	15.91	(323)	4.78	(97)	24	1.77	0.908	4.02	89.9	21.1
52	10.05	(238)	3.00	(71)	28	1.77	0.908	4.02	90.4	24.7
53	16.25	(275)	4.67	(79)	20	1.77	0.908	4.02	93.9	24.3
54	11.14	(264)	3.17	(75)	28	1.77	0.908	4.02	94.9	25.1
55	18.50	(313)	4.55	(77)	20	1.77	0.908	4.02	109.5	28.2
56	12.57	(319)	2.99	(76)	30	1.77	0.908	4.02	113.1	29.2
57	4.07	(141)	0.95	(33)	41	1.77	0.908	4.02	115.1	44.7
58	7.53	(223)	1.59	(47)	35	1.77	0.908	4.02	127.7	41.3
59	18.56	(314)	3.37	(57)	20	1.77	0.908	4.02	148.0	43.0
60	16.50	(335)	2.07	(42)	24	1.77	0.908	4.02	213.2	70.3
61	15.62	(304)	1.49	(29)	23	1.77	0.908	4.02	278.7	108.9

Date, Time: 01-15-1991 09:26:19 Filename: ARC88-16.FTZ
Lab# ZD38 Field# ARC88-16 Western Olympic Assem., SE of Forks, Vance 8/9/90
Number of grains = 61
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	2.82	(86)	2.43	(74)	168	40	31.5	10.1	100.0	31.5	10.1
2	3.04	(90)	2.33	(69)	162	39	35.3	11.4	60.8	33.4	7.6
3	1.84	(59)	1.40	(45)	97	29	35.5	14.1	84.4	33.9	6.8
4	5.17	(153)	3.78	(112)	262	51	37.0	9.3	88.3	35.0	5.6
5	5.68	(173)	3.97	(121)	275	51	38.7	9.3	88.4	36.1	4.9
6	4.85	(123)	3.23	(82)	224	50	40.6	11.7	88.4	36.8	4.6
7	5.50	(186)	3.61	(122)	250	46	41.3	9.8	86.7	37.7	4.2
8	5.71	(140)	3.71	(91)	257	55	41.7	11.3	88.5	38.2	4.0
9	3.55	(144)	2.22	(90)	154	33	43.3	11.8	87.6	38.8	3.9
10	4.86	(144)	2.97	(88)	206	45	44.3	12.1	86.2	39.3	3.8
11	4.79	(154)	2.92	(94)	203	43	44.4	11.7	85.9	39.8	3.7
12	8.56	(210)	5.22	(128)	362	66	44.4	10.1	85.2	40.3	3.5
13	2.49	(82)	1.49	(49)	103	30	45.3	16.5	87.6	40.5	3.5
14	9.46	(240)	5.44	(138)	377	66	47.1	10.2	81.0	41.2	3.4
15	7.20	(256)	4.14	(147)	287	49	47.1	9.9	76.0	41.8	3.3
16	5.81	(167)	2.92	(84)	202	45	53.8	14.6	57.0	42.5	3.3
17	7.78	(237)	3.81	(116)	264	50	55.3	12.7	29.5	43.4	3.2
18	3.88	(115)	1.89	(56)	131	35	55.6	18.2	23.5	43.8	3.2
19	3.22	(120)	1.53	(57)	106	28	57.0	18.5	17.4	44.2	3.2
20	9.23	(281)	4.37	(133)	303	54	57.2	12.2	6.4	45.1	3.2
21	7.88	(240)	3.68	(112)	255	49	58.0	13.5	2.8	45.8	3.2
22	5.65	(172)	2.63	(80)	182	41	58.2	15.9	1.7	46.3	3.2
23	6.30	(192)	2.89	(88)	200	43	59.0	15.4	1.0	46.8	3.1
24	9.16	(186)	4.09	(83)	283	63	60.6	16.2	0.5	47.3	3.1
25	3.86	(147)	1.60	(61)	111	29	65.2	20.0	0.2	47.8	3.1
26	6.08	(216)	2.50	(89)	174	37	65.6	16.7	0.0	48.5	3.1
27	8.83	(224)	3.59	(91)	249	53	66.5	16.8	0.0	49.1	3.1
28	8.38	(248)	3.38	(100)	234	48	67.0	16.1	0.0	49.8	3.1
29	12.41	(315)	5.00	(127)	347	63	67.0	14.4	0.0	50.6	3.1
30	2.63	(89)	1.03	(35)	72	24	68.7	27.6	0.0	50.8	3.1
31	10.40	(264)	4.06	(103)	281	57	69.3	16.3	0.0	51.5	3.2
33	6.35	(188)	2.43	(72)	169	40	70.6	19.8	0.0	52.0	3.2
34	4.55	(127)	1.72	(48)	119	35	71.5	24.4	0.0	52.3	3.2
35	9.81	(274)	3.69	(103)	256	51	71.9	16.9	0.0	52.9	3.2
36	7.40	(169)	2.76	(63)	191	49	72.5	21.6	0.0	53.3	3.2
37	12.23	(207)	4.55	(77)	316	73	72.6	19.6	0.0	53.8	3.2
38	11.28	(229)	4.09	(83)	283	63	74.5	19.3	0.0	54.3	3.2
39	12.66	(225)	4.50	(80)	312	71	76.0	20.0	0.0	54.8	3.2
40	7.03	(214)	2.50	(76)	173	40	76.1	20.5	0.0	55.3	3.2
41	2.93	(99)	1.03	(35)	72	24	76.4	30.2	0.0	55.5	3.2
32	8.87	(255)	3.13	(90)	217	47	76.5	19.0	0.0	56.0	3.2
42	17.84	(317)	6.25	(111)	433	84	77.1	17.3	0.0	56.7	3.2
43	17.53	(267)	6.11	(93)	423	89	77.5	18.9	0.0	57.2	3.2
44	3.89	(112)	1.32	(38)	92	30	79.6	30.1	0.0	57.4	3.2
45	6.97	(165)	2.32	(55)	161	44	81.0	25.4	0.0	57.7	3.2
46	8.03	(163)	2.66	(54)	184	51	81.5	25.8	0.0	58.1	3.2
47	13.93	(271)	4.52	(88)	314	68	83.1	20.7	0.0	58.6	3.2
48	4.73	(160)	1.51	(51)	104	30	84.7	27.4	0.0	58.9	3.3
49	13.18	(223)	4.14	(70)	287	70	86.0	23.8	0.0	59.4	3.3
50	8.23	(195)	2.53	(60)	176	46	87.7	26.1	0.0	59.8	3.3

Date, Time: 01-15-1991 09:26:19 Filename: ARC88-16.FTZ
Lab# ZD38 Field# ARC88-16 Western Olympic Assem., SE of Forks, Vance 8/9/90
Number of grains = 61
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
51	15.91	(323)	4.78	(97)	331	69	89.9	21.1	0.0	60.5	3.3
52	10.05	(238)	3.00	(71)	208	50	90.4	24.7	0.0	61.0	3.3
53	16.25	(275)	4.67	(79)	324	74	93.9	24.3	0.0	61.6	3.3
54	11.14	(264)	3.17	(75)	220	51	94.9	25.1	0.0	62.1	3.3
55	18.50	(313)	4.55	(77)	316	73	109.5	28.2	0.0	62.9	3.4
56	12.57	(319)	2.99	(76)	208	48	113.1	29.2	0.0	63.7	3.4
57	4.07	(141)	0.95	(33)	66	23	115.1	44.7	0.0	64.1	3.4
58	7.53	(223)	1.59	(47)	110	32	127.7	41.3	0.0	64.7	3.4
59	18.56	(314)	3.37	(57)	234	63	148.0	43.0	0.0	65.7	3.5
60	16.50	(335)	2.07	(42)	143	45	213.2	70.3	0.0	67.0	3.5
61	15.62	(304)	1.49	(29)	103	39	278.7	108.9	0.0	68.3	3.6
POOLED	7.53	(12362)	2.98	(4895)	207	10			0.0	68.3	3.6
MEAN AGE (using grain ratios)										74.8	10.8

Date, Time: 01-15-1991 09:26:42 Filename: 8782-2.FTZ
Lab# ZD22, Field# 8782-2 undiff OSC, N Fork Quinault Ranger Stn., Vance 9/19/90
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	6.80	(115)	8.33	(141)	20	1.81	0.927	4.66	22.6	5.8
2	7.88	(120)	9.52	(145)	18	1.81	0.927	4.66	22.9	5.8
3	2.46	(175)	2.70	(192)	84	1.81	0.927	4.66	25.2	5.4
4	7.64	(252)	7.76	(256)	39	1.81	0.927	4.66	27.3	5.0
5	5.50	(107)	5.55	(108)	23	1.81	0.927	4.66	27.4	7.6
6	11.38	(308)	11.38	(308)	32	1.81	0.927	4.66	27.7	4.6
7	6.83	(208)	6.80	(207)	36	1.81	0.927	4.66	27.8	5.6
8	5.74	(136)	5.49	(130)	28	1.81	0.927	4.66	29.0	7.2
9	7.97	(182)	7.27	(166)	27	1.81	0.927	4.66	30.4	6.7
10	9.10	(154)	8.16	(138)	20	1.81	0.927	4.66	30.9	7.4
11	2.24	(91)	1.97	(80)	48	1.81	0.927	4.66	31.5	9.8
12	5.99	(157)	5.26	(138)	31	1.81	0.927	4.66	31.5	7.5
13	13.23	(235)	11.54	(205)	21	1.81	0.927	4.66	31.7	6.2
14	5.73	(218)	4.99	(190)	45	1.81	0.927	4.66	31.8	6.5
15	8.08	(205)	6.82	(173)	30	1.81	0.927	4.66	32.8	6.9
16	11.94	(303)	10.05	(255)	30	1.81	0.927	4.66	32.9	5.8
17	8.81	(149)	7.39	(125)	20	1.81	0.927	4.66	33.0	8.2
18	3.39	(109)	2.80	(90)	38	1.81	0.927	4.66	33.5	9.7
19	7.50	(203)	6.13	(166)	32	1.81	0.927	4.66	33.8	7.3
20	7.92	(181)	6.35	(145)	27	1.81	0.927	4.66	34.5	7.9
21	12.58	(298)	10.01	(237)	28	1.81	0.927	4.66	34.8	6.3
22	6.62	(168)	5.16	(131)	30	1.81	0.927	4.66	35.5	8.4
23	8.84	(202)	6.74	(154)	27	1.81	0.927	4.66	36.3	7.9
24	5.56	(188)	4.23	(143)	40	1.81	0.927	4.66	36.4	8.2
25	3.81	(100)	2.90	(76)	31	1.81	0.927	4.66	36.4	11.2
26	9.41	(191)	6.90	(140)	24	1.81	0.927	4.66	37.7	8.6
27	8.95	(212)	6.46	(153)	28	1.81	0.927	4.66	38.3	8.3
28	6.78	(172)	4.81	(122)	30	1.81	0.927	4.66	39.0	9.4
29	14.11	(191)	9.38	(127)	16	1.81	0.927	4.66	41.6	9.7
30	10.53	(285)	6.87	(186)	32	1.81	0.927	4.66	42.4	8.2
31	10.23	(277)	6.50	(176)	32	1.81	0.927	4.66	43.5	8.6
32	10.27	(278)	6.43	(174)	32	1.81	0.927	4.66	44.2	8.8
33	6.56	(161)	3.95	(97)	29	1.81	0.927	4.66	45.9	12.0
34	10.24	(182)	6.08	(108)	21	1.81	0.927	4.66	46.6	11.5
35	12.72	(226)	7.54	(134)	21	1.81	0.927	4.66	46.6	10.4
36	6.17	(167)	3.66	(99)	32	1.81	0.927	4.66	46.6	12.0
37	12.08	(235)	7.14	(139)	23	1.81	0.927	4.66	46.7	10.2
38	9.61	(244)	5.67	(144)	30	1.81	0.927	4.66	46.9	10.1
39	10.52	(267)	6.07	(154)	30	1.81	0.927	4.66	47.9	10.0
40	8.84	(157)	5.01	(89)	21	1.81	0.927	4.66	48.8	13.1
41	8.74	(170)	4.93	(96)	23	1.81	0.927	4.66	49.0	12.7
42	8.39	(213)	4.14	(105)	30	1.81	0.927	4.66	56.0	13.6
43	3.55	(96)	1.74	(47)	32	1.81	0.927	4.66	56.4	20.3
44	8.92	(166)	4.35	(81)	22	1.81	0.927	4.66	56.6	15.6
45	17.90	(318)	8.05	(143)	21	1.81	0.927	4.66	61.4	12.7
46	11.92	(242)	5.07	(103)	24	1.81	0.927	4.66	64.9	15.6
47	2.08	(67)	0.87	(28)	38	1.81	0.927	4.66	66.1	29.9
48	10.29	(209)	3.64	(74)	24	1.81	0.927	4.66	77.9	21.4
49	10.43	(247)	3.67	(87)	28	1.81	0.927	4.66	78.3	19.9
50	10.76	(273)	3.55	(90)	30	1.81	0.927	4.66	83.6	20.7

Date, Time: 01-15-1991 09:26:42 Filename: 8782-2.FTZ
Lab# ZD22, Field# 8782-2 undiff OSC, N Fork Quinault Ranger Stn., Vance 9/19/90
Number of grains = 50
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	6.80	(115)	8.33	(141)	566	99	22.6	5.8	100.0	22.6	5.8
2	7.88	(120)	9.52	(145)	647	112	22.9	5.8	93.4	22.8	4.1
3	2.46	(175)	2.70	(192)	184	28	25.2	5.4	74.7	23.8	3.4
4	7.64	(252)	7.76	(256)	527	70	27.3	5.0	55.0	25.0	2.9
5	5.50	(107)	5.55	(108)	377	75	27.4	7.6	64.1	25.3	2.8
6	11.38	(308)	11.38	(308)	773	95	27.7	4.6	63.3	25.9	2.5
7	6.83	(208)	6.80	(207)	462	68	27.8	5.6	69.5	26.2	2.4
8	5.74	(136)	5.49	(130)	373	68	29.0	7.2	72.5	26.5	2.3
9	7.97	(182)	7.27	(166)	494	80	30.4	6.7	65.5	26.9	2.3
10	9.10	(154)	8.16	(138)	554	98	30.9	7.4	61.1	27.2	2.2
11	2.24	(91)	1.97	(80)	134	31	31.5	9.8	61.5	27.4	2.2
12	5.99	(157)	5.26	(138)	357	63	31.5	7.5	57.6	27.6	2.2
13	13.23	(235)	11.54	(205)	784	115	31.7	6.2	49.5	28.0	2.1
14	5.73	(218)	4.99	(190)	339	52	31.8	6.5	45.8	28.3	2.1
15	8.08	(205)	6.82	(173)	463	74	32.8	6.9	39.4	28.6	2.1
16	11.94	(303)	10.05	(255)	682	91	32.9	5.8	30.6	29.0	2.0
17	8.81	(149)	7.39	(125)	502	93	33.0	8.2	30.6	29.2	2.0
18	3.39	(109)	2.80	(90)	190	41	33.5	9.7	31.5	29.3	2.0
19	7.50	(203)	6.13	(166)	416	67	33.8	7.3	27.6	29.5	2.0
20	7.92	(181)	6.35	(145)	431	74	34.5	7.9	23.9	29.7	2.0
21	12.58	(298)	10.01	(237)	680	94	34.8	6.3	16.5	30.1	2.0
22	6.62	(168)	5.16	(131)	351	63	35.5	8.4	14.1	30.3	2.0
23	8.84	(202)	6.74	(154)	458	77	36.3	7.9	10.1	30.5	2.0
24	5.56	(188)	4.23	(143)	287	50	36.4	8.2	7.7	30.7	2.0
25	3.81	(100)	2.90	(76)	197	46	36.4	11.2	7.7	30.8	2.0
26	9.41	(191)	6.90	(140)	468	82	37.7	8.6	5.0	31.1	2.0
27	8.95	(212)	6.46	(153)	439	74	38.3	8.3	2.7	31.3	2.0
28	6.78	(172)	4.81	(122)	326	61	39.0	9.4	1.7	31.5	2.0
29	14.11	(191)	9.38	(127)	637	117	41.6	9.7	0.5	31.8	2.0
30	10.53	(285)	6.87	(186)	467	72	42.4	8.2	0.1	32.2	2.0
31	10.23	(277)	6.50	(176)	442	70	43.5	8.6	0.0	32.6	2.0
32	10.27	(278)	6.43	(174)	437	69	44.2	8.8	0.0	33.0	2.0
33	6.56	(161)	3.95	(97)	269	56	45.9	12.0	0.0	33.2	2.0
34	10.24	(182)	6.08	(108)	413	82	46.6	11.5	0.0	33.5	2.0
35	12.72	(226)	7.54	(134)	512	92	46.6	10.4	0.0	33.8	2.0
36	6.17	(167)	3.66	(99)	248	51	46.6	12.0	0.0	34.0	2.0
37	12.08	(235)	7.14	(139)	485	85	46.7	10.2	0.0	34.3	2.0
38	9.61	(244)	5.67	(144)	385	67	46.9	10.1	0.0	34.7	2.0
39	10.52	(267)	6.07	(154)	412	69	47.9	10.0	0.0	35.0	2.0
40	8.84	(157)	5.01	(89)	340	74	48.8	13.1	0.0	35.2	2.0
41	8.74	(170)	4.93	(96)	335	70	49.0	12.7	0.0	35.4	2.0
42	8.39	(213)	4.14	(105)	281	56	56.0	13.6	0.0	35.7	2.1
43	3.55	(96)	1.74	(47)	118	35	56.4	20.3	0.0	35.9	2.1
44	8.92	(166)	4.35	(81)	296	67	56.6	15.6	0.0	36.2	2.1
45	17.90	(318)	8.05	(143)	547	95	61.4	12.7	0.0	36.7	2.1
46	11.92	(242)	5.07	(103)	345	70	64.9	15.6	0.0	37.1	2.1
47	2.08	(67)	0.87	(28)	59	23	66.1	29.9	0.0	37.3	2.1
48	10.29	(209)	3.64	(74)	248	59	77.9	21.4	0.0	37.7	2.1
49	10.43	(247)	3.67	(87)	249	55	78.3	19.9	0.0	38.2	2.2
50	10.76	(273)	3.55	(90)	241	52	83.6	20.7	0.0	38.8	2.2
POOLED	7.85	(9810)	5.59	(6995)	380	20			0.0	38.8	2.2
MEAN AGE (using grain ratios)										41.8	4.5

Date, Time: 01-15-1991 09:26:58 Filename: ARC88-22.FTZ
Lab# ZD44 Field# ARC88-22 undiff. OSC, NW of Quinault Lk Vance 12/17/90
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	9.31	(197)	6.81	(144)	25	1.76	0.899	4.39	36.7	8.2
2	4.80	(130)	3.40	(92)	32	1.76	0.899	4.39	37.9	10.5
3	6.14	(161)	4.04	(106)	31	1.76	0.899	4.39	40.7	10.3
4	7.41	(188)	4.85	(123)	30	1.76	0.899	4.39	41.0	9.7
5	8.12	(213)	4.92	(129)	31	1.76	0.899	4.39	44.3	10.1
6	12.31	(302)	7.62	(187)	29	1.76	0.899	4.39	43.3	8.3
7	18.50	(313)	10.64	(180)	20	1.76	0.899	4.39	46.6	9.0
8	11.36	(269)	6.33	(150)	28	1.76	0.899	4.39	48.1	10.0
9	19.31	(294)	10.31	(157)	18	1.76	0.899	4.39	50.2	10.2
10	8.70	(184)	4.63	(98)	25	1.76	0.899	4.39	50.3	12.8
11	14.04	(285)	7.24	(147)	24	1.76	0.899	4.39	52.0	10.8
12	17.49	(222)	8.90	(113)	15	1.76	0.899	4.39	52.7	12.4
13	11.02	(317)	5.25	(151)	34	1.76	0.899	4.39	56.2	11.4
14	9.27	(196)	4.35	(92)	25	1.76	0.899	4.39	57.1	14.6
15	6.43	(174)	2.99	(81)	32	1.76	0.899	4.39	57.5	15.7
16	13.76	(361)	6.41	(168)	31	1.76	0.899	4.39	57.6	11.0
17	17.49	(296)	7.33	(124)	20	1.76	0.899	4.39	63.9	14.0
18	11.63	(305)	4.69	(123)	31	1.76	0.899	4.39	66.4	14.5
19	18.29	(263)	6.54	(94)	17	1.76	0.899	4.39	74.9	18.3
20	14.46	(208)	5.08	(73)	17	1.76	0.899	4.39	76.2	21.0
21	8.89	(173)	2.98	(58)	23	1.76	0.899	4.39	79.8	24.5
22	12.92	(317)	4.32	(106)	29	1.76	0.899	4.39	80.0	18.3
23	14.58	(222)	4.73	(72)	18	1.76	0.899	4.39	82.4	22.7
24	14.35	(267)	3.06	(57)	22	1.76	0.899	4.39	124.8	36.8
25	14.83	(251)	2.19	(37)	20	1.76	0.899	4.39	180.0	63.9

Date, Time: 01-15-1991 09:26:58 Filename: ARC88-22.FTZ
Lab# ZD44 Field# ARC88-22 undiff. OSC, NW of Quinault Lk Vance 12/17/90
Number of grains = 25
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	9.31	(197)	6.81	(144)	477	82	36.7	8.2	100.0	36.7	8.2
2	4.80	(130)	3.40	(92)	238	51	37.9	10.5	85.3	37.2	6.6
3	6.14	(161)	4.04	(106)	283	56	40.7	10.3	81.8	38.3	5.7
4	7.41	(188)	4.85	(123)	339	63	41.0	9.7	88.3	39.0	5.0
6	12.31	(302)	7.62	(187)	534	82	43.3	8.3	81.5	40.2	4.4
5	8.12	(213)	4.92	(129)	345	63	44.3	10.1	82.3	40.9	4.2
7	18.50	(313)	10.64	(180)	745	116	46.6	9.0	70.6	42.0	3.9
8	11.36	(269)	6.33	(150)	444	75	48.1	10.0	61.9	42.8	3.8
9	19.31	(294)	10.31	(157)	722	120	50.2	10.2	46.9	43.7	3.7
10	8.70	(184)	4.63	(98)	325	67	50.3	12.8	45.2	44.2	3.6
11	14.04	(285)	7.24	(147)	507	87	52.0	10.8	34.3	44.9	3.5
12	17.49	(222)	8.90	(113)	624	120	52.7	12.4	29.5	45.5	3.5
13	11.02	(317)	5.25	(151)	368	62	56.2	11.4	13.9	46.4	3.4
14	9.27	(196)	4.35	(92)	305	65	57.1	14.6	9.8	46.9	3.4
15	6.43	(174)	2.99	(81)	210	47	57.5	15.7	7.5	47.4	3.4
16	13.76	(361)	6.41	(168)	449	72	57.6	11.0	3.5	48.2	3.4
17	17.49	(296)	7.33	(124)	513	95	63.9	14.0	0.7	49.0	3.4
18	11.63	(305)	4.69	(123)	329	61	66.4	14.5	0.1	49.9	3.4
19	18.29	(263)	6.54	(94)	458	97	74.9	18.3	0.0	50.9	3.4
20	14.46	(208)	5.08	(73)	356	85	76.2	21.0	0.0	51.6	3.4
21	8.89	(173)	2.98	(58)	209	56	79.8	24.5	0.0	52.3	3.4
22	12.92	(317)	4.32	(106)	303	60	80.0	18.3	0.0	53.4	3.4
23	14.58	(222)	4.73	(72)	331	79	82.4	22.7	0.0	54.1	3.5
24	14.35	(267)	3.06	(57)	215	58	124.8	36.8	0.0	55.6	3.5
25	14.83	(251)	2.19	(37)	153	51	180.0	63.9	0.0	57.2	3.6
POOLED	11.51	(6108)	5.40	(2862)	378	22			0.0	57.2	3.6
MEAN AGE (using grain ratios)										64.1	12.8

Date, Time: 01-15-1991 09:27:16 Filename: 8892-1.FTZ
Lab# ZD50, Field# 8892-1 Twog, W. Olympic Assem., Glacier Crk, Vance 12/29/90
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	6.05	(210)	6.69	(232)	41	1.74	0.890	5.11	24.1	4.7
2	5.27	(156)	5.57	(165)	35	1.74	0.890	5.11	25.1	5.8
3	3.89	(125)	4.11	(132)	38	1.74	0.890	5.11	25.2	6.4
4	7.50	(222)	5.91	(175)	35	1.74	0.890	5.11	33.7	7.0
5	6.93	(176)	4.81	(122)	30	1.74	0.890	5.11	38.3	9.2
6	7.55	(198)	4.84	(127)	31	1.74	0.890	5.11	41.4	9.6
7	13.68	(243)	8.50	(151)	21	1.74	0.890	5.11	42.7	9.1
8	9.01	(221)	5.46	(134)	29	1.74	0.890	5.11	43.8	9.8
9	18.32	(372)	10.59	(215)	24	1.74	0.890	5.11	45.9	8.2
10	16.50	(335)	9.31	(189)	24	1.74	0.890	5.11	47.1	8.9
11	4.26	(144)	2.30	(78)	40	1.74	0.890	5.11	49.0	14.0
12	9.46	(152)	4.98	(80)	19	1.74	0.890	5.11	50.4	14.2
13	9.79	(290)	5.03	(149)	35	1.74	0.890	5.11	51.6	10.7
14	17.01	(259)	7.88	(120)	18	1.74	0.890	5.11	57.2	13.0
15	7.29	(185)	3.27	(83)	30	1.74	0.890	5.11	59.1	15.9
16	19.83	(302)	7.68	(117)	18	1.74	0.890	5.11	68.4	15.3
17	8.47	(215)	3.27	(83)	30	1.74	0.890	5.11	68.6	18.1
18	26.34	(312)	9.71	(115)	14	1.74	0.890	5.11	71.9	16.1
19	16.05	(421)	5.87	(154)	31	1.74	0.890	5.11	72.4	14.1
20	13.23	(291)	4.46	(98)	26	1.74	0.890	5.11	78.6	18.8
21	12.28	(239)	4.11	(80)	23	1.74	0.890	5.11	79.1	20.8
22	12.87	(283)	4.27	(94)	26	1.74	0.890	5.11	79.7	19.4
23	25.35	(386)	8.41	(128)	18	1.74	0.890	5.11	79.8	16.8
24	13.00	(253)	3.55	(69)	23	1.74	0.890	5.11	97.0	26.8
25	13.73	(244)	3.60	(64)	21	1.74	0.890	5.11	100.8	28.8

Date, Time: 01-15-1991 09:27:16 Filename: 8892-1.FTZ
Lab# ZD50, Field# 8892-1 Twog, W. Olympic Assem., Glacier Crk, Vance 12/29/90
Number of grains = 25
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	6.05	(210)	6.69	(232)	473	67	24.1	4.7	100.0	24.1	4.7
2	5.27	(156)	5.57	(165)	394	65	25.1	5.8	76.7	24.5	3.8
3	3.89	(125)	4.11	(132)	290	53	25.2	6.4	94.1	24.7	3.3
4	7.50	(222)	5.91	(175)	418	67	33.7	7.0	7.0	26.9	3.2
5	6.93	(176)	4.81	(122)	340	64	38.3	9.2	0.6	28.6	3.1
6	7.55	(198)	4.84	(127)	343	63	41.4	9.6	0.0	30.3	3.1
7	13.68	(243)	8.50	(151)	601	103	42.7	9.1	0.0	32.0	3.1
8	9.01	(221)	5.46	(134)	386	70	43.8	9.8	0.0	33.3	3.1
9	18.32	(372)	10.59	(215)	749	109	45.9	8.2	0.0	35.2	3.0
10	16.50	(335)	9.31	(189)	658	102	47.1	8.9	0.0	36.5	3.0
11	4.26	(144)	2.30	(78)	163	38	49.0	14.0	0.0	37.1	3.0
12	9.46	(152)	4.98	(80)	352	81	50.4	14.2	0.0	37.7	3.0
13	9.79	(290)	5.03	(149)	356	61	51.6	10.7	0.0	38.8	3.0
14	17.01	(259)	7.88	(120)	557	106	57.2	13.0	0.0	39.8	3.0
15	7.29	(185)	3.27	(83)	231	52	59.1	15.9	0.0	40.6	3.1
16	19.83	(302)	7.68	(117)	543	104	68.4	15.3	0.0	42.0	3.1
17	8.47	(215)	3.27	(83)	231	52	68.6	18.1	0.0	43.0	3.1
18	26.34	(312)	9.71	(115)	687	133	71.9	16.1	0.0	44.3	3.2
19	16.05	(421)	5.87	(154)	415	70	72.4	14.1	0.0	46.0	3.3
20	13.23	(291)	4.46	(98)	315	66	78.6	18.8	0.0	47.1	3.3
21	12.28	(239)	4.11	(80)	291	67	79.1	20.8	0.0	48.1	3.3
22	12.87	(283)	4.27	(94)	302	64	79.7	19.4	0.0	49.1	3.4
23	25.35	(386)	8.41	(128)	595	109	79.8	16.8	0.0	50.4	3.4
24	13.00	(253)	3.55	(69)	251	62	97.0	26.8	0.0	51.4	3.5
25	13.73	(244)	3.60	(64)	255	65	100.8	28.8	0.0	52.4	3.5
POOLED	10.84	(6234)	5.48	(3154)	388	24			0.0	52.4	3.5
MEAN AGE (using grain ratios)										57.3	9.2

Date, Time: 01-15-1991 09:28:37 Filename: MTTOM.FTZ
Lab# ZD6 Field# V312 Twos, Western Olympic Assem., Mount Tom Vance 1/25/88
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	1.20	(54)	2.65	(119)	53	2.01	1.030	3.84	14.0	4.6
2	0.55	(22)	1.21	(48)	47	2.01	1.030	3.84	14.1	7.3
3	1.42	(71)	3.11	(155)	59	2.01	1.030	3.84	14.1	4.1
4	1.45	(48)	2.58	(85)	39	2.01	1.030	3.84	17.4	6.3
5	1.90	(58)	3.25	(99)	36	2.01	1.030	3.84	18.0	6.0
6	1.72	(51)	2.80	(83)	35	2.01	1.030	3.84	18.9	6.8
7	0.94	(35)	1.50	(56)	44	2.01	1.030	3.84	19.2	8.3
8	1.35	(56)	2.07	(86)	49	2.01	1.030	3.84	20.0	6.9
9	3.14	(69)	4.82	(106)	26	2.01	1.030	3.84	20.0	6.2
10	1.02	(32)	1.57	(49)	37	2.01	1.030	3.84	20.1	9.2
11	0.93	(69)	1.38	(103)	88	2.01	1.030	3.84	20.6	6.5
12	1.93	(57)	2.84	(84)	35	2.01	1.030	3.84	20.9	7.2
13	2.52	(79)	3.64	(114)	37	2.01	1.030	3.84	21.3	6.3
14	2.36	(66)	2.58	(72)	33	2.01	1.030	3.84	28.2	9.7
15	1.26	(31)	1.22	(30)	29	2.01	1.030	3.84	31.8	16.3
16	3.29	(78)	2.83	(67)	28	2.01	1.030	3.84	35.8	12.0
17	2.14	(87)	1.70	(69)	48	2.01	1.030	3.84	38.7	12.6
18	5.28	(152)	4.17	(120)	34	2.01	1.030	3.84	38.9	9.6
19	2.00	(76)	1.52	(58)	45	2.01	1.030	3.84	40.3	14.1
20	4.28	(134)	3.23	(101)	37	2.01	1.030	3.84	40.8	10.9
21	2.03	(96)	1.52	(72)	56	2.01	1.030	3.84	41.0	12.9
22	4.54	(119)	3.36	(88)	31	2.01	1.030	3.84	41.5	11.8
23	5.86	(124)	4.21	(89)	25	2.01	1.030	3.84	42.8	12.0
24	5.45	(129)	3.76	(89)	28	2.01	1.030	3.84	44.5	12.4
25	2.70	(89)	1.85	(61)	39	2.01	1.030	3.84	44.8	15.0
26	4.16	(116)	2.79	(78)	33	2.01	1.030	3.84	45.7	13.5
27	7.05	(155)	4.73	(104)	26	2.01	1.030	3.84	45.8	11.7
28	4.22	(107)	2.80	(71)	30	2.01	1.030	3.84	46.3	14.3
29	13.89	(235)	8.69	(147)	20	2.01	1.030	3.84	49.1	10.5
30	2.17	(79)	1.32	(48)	43	2.01	1.030	3.84	50.5	18.6
31	4.65	(122)	2.82	(74)	31	2.01	1.030	3.84	50.6	15.0
32	6.68	(96)	3.75	(54)	17	2.01	1.030	3.84	54.6	18.7
33	3.40	(72)	1.89	(40)	25	2.01	1.030	3.84	55.2	21.9
34	5.49	(130)	2.87	(68)	28	2.01	1.030	3.84	58.7	17.7
35	4.41	(209)	2.30	(109)	56	2.01	1.030	3.84	58.8	14.1
36	2.57	(76)	1.32	(39)	35	2.01	1.030	3.84	59.8	23.7
37	6.56	(172)	3.32	(87)	31	2.01	1.030	3.84	60.7	16.1
38	5.34	(113)	2.60	(55)	25	2.01	1.030	3.84	63.0	20.9
39	6.33	(166)	3.05	(80)	31	2.01	1.030	3.84	63.6	17.5
40	6.25	(164)	2.94	(77)	31	2.01	1.030	3.84	65.3	18.2
41	4.38	(174)	2.01	(80)	47	2.01	1.030	3.84	66.7	18.2
42	5.75	(141)	2.45	(60)	29	2.01	1.030	3.84	72.0	22.4
43	3.67	(143)	1.54	(60)	46	2.01	1.030	3.84	73.0	22.6
44	4.68	(99)	1.84	(39)	25	2.01	1.030	3.84	77.8	29.6
45	7.14	(157)	2.73	(60)	26	2.01	1.030	3.84	80.2	24.5
46	2.94	(122)	1.11	(46)	49	2.01	1.030	3.84	81.2	28.3
47	3.29	(117)	1.24	(44)	42	2.01	1.030	3.84	81.4	29.0
48	4.60	(144)	1.53	(48)	37	2.01	1.030	3.84	91.8	30.8
49	8.14	(186)	1.62	(37)	27	2.01	1.030	3.84	153.1	55.4
50	8.13	(289)	1.27	(45)	42	2.01	1.030	3.84	195.0	62.9

Date, Time: 01-15-1991 09:28:37 Filename: MTTOM.FTZ
Lab# ZD6 Field# V312 Twos, Western Olympic Assem., Mount Tom Vance 1/25/88
Number of grains = 50
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	1.20	(54)	2.65	(119)	162	30	14.0	4.6	100.0	14.0	4.6
3	1.42	(71)	3.11	(155)	190	31	14.1	4.1	96.6	14.0	3.1
2	0.55	(22)	1.21	(48)	74	22	14.1	7.3	99.9	14.1	2.8
4	1.45	(48)	2.58	(85)	158	35	17.4	6.3	78.5	14.8	2.6
5	1.90	(58)	3.25	(99)	199	41	18.0	6.0	69.7	15.4	2.4
6	1.72	(51)	2.80	(83)	172	38	18.9	6.8	65.0	15.9	2.3
7	0.94	(35)	1.50	(56)	92	25	19.2	8.3	67.4	16.2	2.3
9	3.14	(69)	4.82	(106)	295	58	20.0	6.2	58.8	16.7	2.2
8	1.35	(56)	2.07	(86)	127	28	20.0	6.9	58.6	17.1	2.1
10	1.02	(32)	1.57	(49)	96	28	20.1	9.2	63.5	17.2	2.0
11	0.93	(69)	1.38	(103)	85	17	20.6	6.5	61.3	17.6	2.0
12	1.93	(57)	2.84	(84)	174	38	20.9	7.2	61.7	17.8	1.9
13	2.52	(79)	3.64	(114)	223	43	21.3	6.3	58.6	18.2	1.9
14	2.36	(66)	2.58	(72)	158	38	28.2	9.7	22.3	18.8	1.9
15	1.26	(31)	1.22	(30)	75	27	31.8	16.3	11.1	19.1	1.9
16	3.29	(78)	2.83	(67)	173	43	35.8	12.0	0.3	19.9	1.9
17	2.14	(87)	1.70	(69)	104	25	38.7	12.6	0.0	20.8	1.9
18	5.28	(152)	4.17	(120)	255	48	38.9	9.6	0.0	22.2	1.9
19	2.00	(76)	1.52	(58)	93	25	40.3	14.1	0.0	22.9	2.0
20	4.28	(134)	3.23	(101)	197	40	40.8	10.9	0.0	23.9	2.0
21	2.03	(96)	1.52	(72)	93	22	41.0	12.9	0.0	24.6	2.0
22	4.54	(119)	3.36	(88)	205	44	41.5	11.8	0.0	25.4	2.0
23	5.86	(124)	4.21	(89)	258	55	42.8	12.0	0.0	26.2	2.0
24	5.45	(129)	3.76	(89)	230	50	44.5	12.4	0.0	27.0	2.0
25	2.70	(89)	1.85	(61)	113	29	44.8	15.0	0.0	27.5	2.0
26	4.16	(116)	2.79	(78)	171	39	45.7	13.5	0.0	28.2	2.1
27	7.05	(155)	4.73	(104)	289	58	45.8	11.7	0.0	29.0	2.1
28	4.22	(107)	2.80	(71)	171	41	46.3	14.3	0.0	29.5	2.1
29	13.89	(235)	8.69	(147)	532	90	49.1	10.5	0.0	30.7	2.1
30	2.17	(79)	1.32	(48)	81	24	50.5	18.6	0.0	31.0	2.1
31	4.65	(122)	2.82	(74)	173	41	50.6	15.0	0.0	31.6	2.1
32	6.68	(96)	3.75	(54)	230	63	54.6	18.7	0.0	32.0	2.1
33	3.40	(72)	1.89	(40)	116	37	55.2	21.9	0.0	32.4	2.1
34	5.49	(130)	2.87	(68)	176	43	58.7	17.7	0.0	33.0	2.2
35	4.41	(209)	2.30	(109)	141	28	58.8	14.1	0.0	34.0	2.2
36	2.57	(76)	1.32	(39)	81	26	59.8	23.7	0.0	34.3	2.2
37	6.56	(172)	3.32	(87)	203	44	60.7	16.1	0.0	35.1	2.2
38	5.34	(113)	2.60	(55)	159	43	63.0	20.9	0.0	35.6	2.2
39	6.33	(166)	3.05	(80)	187	42	63.6	17.5	0.0	36.3	2.2
40	6.25	(164)	2.94	(77)	180	42	65.3	18.2	0.0	37.0	2.3
41	4.38	(174)	2.01	(80)	123	28	66.7	18.2	0.0	37.7	2.3
42	5.75	(141)	2.45	(60)	150	39	72.0	22.4	0.0	38.3	2.3
43	3.67	(143)	1.54	(60)	94	25	73.0	22.6	0.0	38.9	2.3
44	4.68	(99)	1.84	(39)	113	36	77.8	29.6	0.0	39.4	2.3
45	7.14	(157)	2.73	(60)	167	44	80.2	24.5	0.0	40.1	2.4
46	2.94	(122)	1.11	(46)	68	20	81.2	28.3	0.0	40.6	2.4
47	3.29	(117)	1.24	(44)	76	23	81.4	29.0	0.0	41.1	2.4
48	4.60	(144)	1.53	(48)	94	27	91.8	30.8	0.0	41.8	2.4
49	8.14	(186)	1.62	(37)	99	33	153.1	55.4	0.0	42.9	2.5
50	8.13	(289)	1.27	(45)	78	23	195.0	62.9	0.0	44.7	2.6
POOLED	3.49	(5466)	2.40	(3753)	147	7			0.0	44.7	2.6
MEAN AGE (using grain ratios)										50.2	9.7

Date, Time: 01-15-1991 09:28:55 Filename: 8889-2.FTZ
Lab# ZD49 Field 8889-2 Grand Valley Assem., Wellesley Peak Vance 3/31/90
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	3.03	(100)	6.03	(199)	39	1.86	0.954	5.26	14.3	3.6
2	1.93	(80)	3.84	(159)	49	1.86	0.954	5.26	14.3	4.0
3	5.79	(93)	11.20	(180)	19	1.86	0.954	5.26	14.7	3.8
4	3.37	(94)	6.02	(168)	33	1.86	0.954	5.26	16.0	4.2
5	3.94	(120)	6.99	(213)	36	1.86	0.954	5.26	16.1	3.8
6	6.28	(186)	10.60	(314)	35	1.86	0.954	5.26	16.9	3.2
7	1.18	(65)	1.87	(103)	65	1.86	0.954	5.26	18.0	5.8
8	2.20	(91)	3.43	(142)	49	1.86	0.954	5.26	18.3	5.0
9	2.48	(84)	3.72	(126)	40	1.86	0.954	5.26	19.0	5.4
10	3.68	(112)	5.42	(165)	36	1.86	0.954	5.26	19.3	4.8
11	3.13	(90)	4.45	(128)	34	1.86	0.954	5.26	20.0	5.6
12	1.79	(56)	2.46	(77)	37	1.86	0.954	5.26	20.7	7.4
13	4.37	(111)	5.91	(150)	30	1.86	0.954	5.26	21.1	5.4
14	7.49	(152)	10.05	(204)	24	1.86	0.954	5.26	21.2	4.7
15	2.03	(110)	2.71	(147)	64	1.86	0.954	5.26	21.3	5.5
16	4.00	(105)	5.30	(139)	31	1.86	0.954	5.26	21.5	5.7
17	11.28	(210)	13.92	(259)	22	1.86	0.954	5.26	23.1	4.5
18	4.43	(180)	5.44	(221)	48	1.86	0.954	5.26	23.2	4.8
19	2.70	(146)	3.31	(179)	64	1.86	0.954	5.26	23.2	5.3
20	9.99	(186)	11.77	(219)	22	1.86	0.954	5.26	24.2	5.0
21	3.29	(78)	3.84	(91)	28	1.86	0.954	5.26	24.4	7.6
22	2.22	(77)	2.51	(87)	41	1.86	0.954	5.26	25.2	8.0
23	9.97	(270)	11.16	(302)	32	1.86	0.954	5.26	25.5	4.5
24	7.44	(170)	8.23	(188)	27	1.86	0.954	5.26	25.8	5.6
25	2.51	(87)	2.77	(96)	41	1.86	0.954	5.26	25.8	7.8
26	5.74	(131)	6.17	(141)	27	1.86	0.954	5.26	26.5	6.6
27	8.57	(232)	9.05	(245)	32	1.86	0.954	5.26	27.0	5.1
28	7.39	(175)	7.77	(184)	28	1.86	0.954	5.26	27.1	5.9
29	4.21	(114)	4.32	(117)	32	1.86	0.954	5.26	27.8	7.4
30	7.68	(143)	7.68	(143)	22	1.86	0.954	5.26	28.5	6.9
31	4.65	(118)	4.53	(115)	30	1.86	0.954	5.26	29.2	7.8
32	11.55	(254)	11.00	(242)	26	1.86	0.954	5.26	29.9	5.6
33	9.46	(184)	8.69	(169)	23	1.86	0.954	5.26	31.0	6.8
34	7.20	(201)	6.59	(184)	33	1.86	0.954	5.26	31.1	6.6
35	5.21	(141)	4.62	(125)	32	1.86	0.954	5.26	32.1	8.1
36	2.97	(108)	2.50	(91)	43	1.86	0.954	5.26	33.8	9.8
37	8.56	(152)	7.15	(127)	21	1.86	0.954	5.26	34.1	8.4
38	9.99	(169)	7.57	(128)	20	1.86	0.954	5.26	37.6	9.0
39	14.18	(336)	10.68	(253)	28	1.86	0.954	5.26	37.8	6.6
40	5.83	(138)	3.84	(91)	28	1.86	0.954	5.26	43.1	11.9
41	3.01	(89)	1.86	(55)	35	1.86	0.954	5.26	46.0	16.0
42	13.17	(234)	7.82	(139)	21	1.86	0.954	5.26	47.9	10.6
43	8.53	(166)	4.83	(94)	23	1.86	0.954	5.26	50.2	13.2
44	5.63	(143)	3.07	(78)	30	1.86	0.954	5.26	52.1	14.9
45	6.92	(123)	3.77	(67)	21	1.86	0.954	5.26	52.2	16.1
46	10.80	(201)	5.80	(108)	22	1.86	0.954	5.26	52.9	12.9
47	4.59	(97)	2.46	(52)	25	1.86	0.954	5.26	53.0	18.4
48	6.74	(171)	3.51	(89)	30	1.86	0.954	5.26	54.6	14.6
49	5.09	(181)	2.39	(85)	42	1.86	0.954	5.26	60.5	16.2
50	3.62	(147)	1.63	(66)	48	1.86	0.954	5.26	63.3	19.0
51	6.05	(169)	2.40	(67)	33	1.86	0.954	5.26	71.6	21.0
52	10.00	(203)	3.40	(69)	24	1.86	0.954	5.26	83.4	23.7
53	4.35	(140)	1.46	(47)	38	1.86	0.954	5.26	84.5	28.8
54	13.73	(244)	3.10	(55)	21	1.86	0.954	5.26	125.4	38.0
55	19.31	(245)	2.36	(30)	15	1.86	0.954	5.26	229.0	89.4

Date, Time: 01-15-1991 09:28:55 Filename: 8889-2.FTZ
Lab# ZD49 Field 8889-2 Grand Valley Assem., Wellesley Peak Vance 3/31/90
Number of grains = 55
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	3.03	(100)	6.03	(199)	398	60	14.3	3.6	100.0	14.3	3.6
2	1.93	(80)	3.84	(159)	253	42	14.3	4.0	99.5	14.3	2.7
3	5.79	(93)	11.20	(180)	739	117	14.7	3.8	98.5	14.5	2.3
4	3.37	(94)	6.02	(168)	397	65	16.0	4.2	92.7	14.8	2.1
5	3.94	(120)	6.99	(213)	462	68	16.1	3.8	93.4	15.1	1.9
6	6.28	(186)	10.60	(314)	700	87	16.9	3.2	86.4	15.6	1.7
7	1.18	(65)	1.87	(103)	124	25	18.0	5.8	85.1	15.7	1.7
8	2.20	(91)	3.43	(142)	226	40	18.3	5.0	80.9	16.0	1.6
9	2.48	(84)	3.72	(126)	246	46	19.0	5.4	74.7	16.2	1.6
10	3.68	(112)	5.42	(165)	358	59	19.3	4.8	64.4	16.5	1.6
11	3.13	(90)	4.45	(128)	294	54	20.0	5.6	55.7	16.8	1.5
12	1.79	(56)	2.46	(77)	162	38	20.7	7.4	51.9	16.9	1.5
13	4.37	(111)	5.91	(150)	390	67	21.1	5.4	37.1	17.2	1.5
14	7.49	(152)	10.05	(204)	663	99	21.2	4.7	22.8	17.6	1.5
15	2.03	(110)	2.71	(147)	179	31	21.3	5.5	18.2	17.8	1.5
16	4.00	(105)	5.30	(139)	350	62	21.5	5.7	15.0	18.0	1.5
17	11.28	(210)	13.92	(259)	919	124	23.1	4.5	4.1	18.4	1.5
18	4.43	(180)	5.44	(221)	359	52	23.2	4.8	1.6	18.8	1.5
19	2.70	(146)	3.31	(179)	218	35	23.2	5.3	0.9	19.0	1.5
20	9.99	(186)	11.77	(219)	777	113	24.2	5.0	0.3	19.4	1.4
21	3.29	(78)	3.84	(91)	254	55	24.4	7.6	0.2	19.5	1.4
22	2.22	(77)	2.51	(87)	166	37	25.2	8.0	0.2	19.6	1.4
23	9.97	(270)	11.16	(302)	737	93	25.5	4.5	0.0	20.1	1.4
24	7.44	(170)	8.23	(188)	543	84	25.8	5.6	0.0	20.3	1.4
25	2.51	(87)	2.77	(96)	183	39	25.8	7.8	0.0	20.4	1.4
26	5.74	(131)	6.17	(141)	408	72	26.5	6.6	0.0	20.6	1.4
27	8.57	(232)	9.05	(245)	598	83	27.0	5.1	0.0	21.0	1.5
28	7.39	(175)	7.77	(184)	513	80	27.1	5.9	0.0	21.2	1.5
29	4.21	(114)	4.32	(117)	285	55	27.8	7.4	0.0	21.4	1.5
30	7.68	(143)	7.68	(143)	507	89	28.5	6.9	0.0	21.6	1.5
31	4.65	(118)	4.53	(115)	299	58	29.2	7.8	0.0	21.7	1.5
32	11.55	(254)	11.00	(242)	726	101	29.9	5.6	0.0	22.1	1.5
33	9.46	(184)	8.69	(169)	573	93	31.0	6.8	0.0	22.4	1.5
34	7.20	(201)	6.59	(184)	435	68	31.1	6.6	0.0	22.6	1.5
35	5.21	(141)	4.62	(125)	305	57	32.1	8.1	0.0	22.8	1.5
36	2.97	(108)	2.50	(91)	165	36	33.8	9.8	0.0	23.0	1.5
37	8.56	(152)	7.15	(127)	472	87	34.1	8.4	0.0	23.2	1.5
38	9.99	(169)	7.57	(128)	499	92	37.6	9.0	0.0	23.5	1.5
39	14.18	(336)	10.68	(253)	705	96	37.8	6.6	0.0	24.1	1.5
40	5.83	(138)	3.84	(91)	254	55	43.1	11.9	0.0	24.3	1.6
41	3.01	(89)	1.86	(55)	123	34	46.0	16.0	0.0	24.5	1.6
42	13.17	(234)	7.82	(139)	517	92	47.9	10.6	0.0	25.0	1.6
43	8.53	(166)	4.83	(94)	319	68	50.2	13.2	0.0	25.3	1.6
44	5.63	(143)	3.07	(78)	203	47	52.1	14.9	0.0	25.6	1.6
45	6.92	(123)	3.77	(67)	249	62	52.2	16.1	0.0	25.9	1.6
46	10.80	(201)	5.80	(108)	383	76	52.9	12.9	0.0	26.3	1.6
47	4.59	(97)	2.46	(52)	162	46	53.0	18.4	0.0	26.5	1.7
48	6.74	(171)	3.51	(89)	232	51	54.6	14.6	0.0	26.8	1.7
49	5.09	(181)	2.39	(85)	158	35	60.5	16.2	0.0	27.2	1.7
50	3.62	(147)	1.63	(66)	107	27	63.3	19.0	0.0	27.6	1.7
51	6.05	(169)	2.40	(67)	158	40	71.6	21.0	0.0	27.9	1.7
52	10.00	(203)	3.40	(69)	224	55	83.4	23.7	0.0	28.5	1.8
53	4.35	(140)	1.46	(47)	97	29	84.5	28.8	0.0	28.8	1.8
54	13.73	(244)	3.10	(55)	204	56	125.4	38.0	0.0	29.5	1.8
55	19.31	(245)	2.36	(30)	156	58	229.0	89.4	0.0	30.3	1.9
POOLED	5.39	(8202)	5.07	(7712)	335	19			0.0	30.3	1.9
MEAN AGE (using grain ratios)										38.6	9.4

Date, Time: 01-15-1991 09:29:10 Filename: 86L-2.FTZ
Lab# ZD2 Field# 86L-2 Grand Valley Assem., Hurricane Ridge Vance 5/10/90
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	5.17	(118)	6.35	(145)	27	1.78	0.914	4.03	22.2	5.6
2	2.26	(90)	2.36	(94)	47	1.78	0.914	4.03	26.1	7.8
3	0.99	(56)	0.95	(54)	67	1.78	0.914	4.03	28.3	10.9
4	8.04	(245)	7.42	(226)	36	1.78	0.914	4.03	29.6	5.6
5	6.24	(190)	5.38	(164)	36	1.78	0.914	4.03	31.6	6.9
6	13.22	(246)	11.07	(206)	22	1.78	0.914	4.03	32.6	6.3
7	3.74	(95)	3.07	(78)	30	1.78	0.914	4.03	33.2	10.2
8	11.77	(239)	9.46	(192)	24	1.78	0.914	4.03	34.0	6.7
9	1.76	(52)	1.38	(41)	35	1.78	0.914	4.03	34.6	14.5
10	1.77	(45)	1.38	(35)	30	1.78	0.914	4.03	35.1	15.9
11	4.25	(133)	3.26	(102)	37	1.78	0.914	4.03	35.6	9.5
12	7.18	(164)	5.25	(120)	27	1.78	0.914	4.03	37.3	9.1
13	13.53	(206)	9.46	(144)	18	1.78	0.914	4.03	39.0	8.6
14	9.50	(225)	6.59	(156)	28	1.78	0.914	4.03	39.3	8.3
15	9.60	(203)	6.43	(136)	25	1.78	0.914	4.03	40.7	9.2
16	0.57	(24)	0.38	(16)	50	1.78	0.914	4.03	40.9	26.5
17	6.24	(169)	4.10	(111)	32	1.78	0.914	4.03	41.5	10.3
18	7.98	(189)	5.07	(120)	28	1.78	0.914	4.03	42.9	10.2
19	5.65	(215)	3.57	(136)	45	1.78	0.914	4.03	43.1	9.6
20	2.36	(96)	1.48	(60)	48	1.78	0.914	4.03	43.6	14.5
21	2.27	(96)	1.42	(60)	50	1.78	0.914	4.03	43.6	14.5
22	10.59	(215)	6.35	(129)	24	1.78	0.914	4.03	45.4	10.3
23	5.67	(187)	3.39	(112)	39	1.78	0.914	4.03	45.5	11.0
24	3.88	(141)	2.28	(83)	43	1.78	0.914	4.03	46.3	12.9
25	12.78	(292)	7.44	(170)	27	1.78	0.914	4.03	46.8	9.2
26	14.54	(283)	8.12	(158)	23	1.78	0.914	4.03	48.8	9.9
27	6.36	(156)	3.46	(85)	29	1.78	0.914	4.03	50.0	13.6
28	13.69	(278)	7.44	(151)	24	1.78	0.914	4.03	50.2	10.3
29	8.50	(230)	4.47	(121)	32	1.78	0.914	4.03	51.8	11.8
30	4.19	(85)	2.17	(44)	24	1.78	0.914	4.03	52.6	19.7
31	11.54	(205)	5.97	(106)	21	1.78	0.914	4.03	52.7	12.8
32	11.62	(236)	6.01	(122)	24	1.78	0.914	4.03	52.7	11.9
33	19.03	(322)	9.81	(166)	20	1.78	0.914	4.03	52.8	10.3
34	8.63	(219)	4.41	(112)	30	1.78	0.914	4.03	53.3	12.6
35	6.93	(170)	3.46	(85)	29	1.78	0.914	4.03	54.5	14.6
36	5.25	(160)	2.63	(80)	36	1.78	0.914	4.03	54.5	15.1
37	9.11	(239)	4.54	(119)	31	1.78	0.914	4.03	54.7	12.5
38	4.59	(167)	2.28	(83)	43	1.78	0.914	4.03	54.8	14.9
39	10.50	(231)	5.18	(114)	26	1.78	0.914	4.03	55.2	12.8
40	2.30	(78)	1.12	(38)	40	1.78	0.914	4.03	55.9	22.2
41	7.83	(212)	3.58	(97)	32	1.78	0.914	4.03	59.5	14.8
42	13.00	(264)	5.86	(119)	24	1.78	0.914	4.03	60.4	13.6
43	5.47	(162)	2.30	(68)	35	1.78	0.914	4.03	64.8	18.9
44	11.65	(266)	4.77	(109)	27	1.78	0.914	4.03	66.4	15.3
45	13.11	(233)	5.35	(95)	21	1.78	0.914	4.03	66.7	16.5
46	7.51	(286)	3.05	(116)	45	1.78	0.914	4.03	67.1	15.0
47	10.82	(183)	4.20	(71)	20	1.78	0.914	4.03	70.1	19.8
48	5.21	(150)	1.70	(49)	34	1.78	0.914	4.03	83.2	27.6
49	7.96	(202)	2.32	(59)	30	1.78	0.914	4.03	93.0	27.8
50	9.93	(294)	2.74	(81)	35	1.78	0.914	4.03	98.5	25.0
51	4.45	(128)	1.22	(35)	34	1.78	0.914	4.03	99.3	38.1
52	11.25	(257)	2.80	(64)	27	1.78	0.914	4.03	108.9	30.7
53	16.77	(227)	3.69	(50)	16	1.78	0.914	4.03	123.0	38.7
54	7.13	(187)	1.53	(40)	31	1.78	0.914	4.03	126.6	44.4
55	4.96	(130)	0.69	(18)	31	1.78	0.914	4.03	194.6	98.2

Date, Time: 01-15-1991 09:29:10 Filename: 86L-2.FTZ
Lab# ZD2 Field# 86L-2 Grand Valley Assem., Hurricane Ridge Vance 5/10/90
Number of grains = 55
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	5.17	(118)	6.35	(145)	437	75	22.2	5.6	100.0	22.2	5.6
2	2.26	(90)	2.36	(94)	163	34	26.1	7.8	39.9	23.8	4.6
3	0.99	(56)	0.95	(54)	66	18	28.3	10.9	49.9	24.6	4.3
4	8.04	(245)	7.42	(226)	511	71	29.6	5.6	31.2	26.8	3.5
5	6.24	(190)	5.38	(164)	371	60	31.6	6.9	25.0	27.9	3.2
6	13.22	(246)	11.07	(206)	763	111	32.6	6.3	19.2	29.0	3.0
7	3.74	(95)	3.07	(78)	212	49	33.2	10.2	22.8	29.4	2.9
8	11.77	(239)	9.46	(192)	652	98	34.0	6.7	18.7	30.1	2.7
9	1.76	(52)	1.38	(41)	95	30	34.6	14.5	23.4	30.3	2.7
10	1.77	(45)	1.38	(35)	95	32	35.1	15.9	28.4	30.4	2.7
11	4.25	(133)	3.26	(102)	225	45	35.6	9.5	27.2	30.8	2.6
12	7.18	(164)	5.25	(120)	362	68	37.3	9.1	20.5	31.3	2.6
13	13.53	(206)	9.46	(144)	652	112	39.0	8.6	10.8	32.0	2.5
14	9.50	(225)	6.59	(156)	454	75	39.3	8.3	5.8	32.7	2.5
15	9.60	(203)	6.43	(136)	443	78	40.7	9.2	3.0	33.2	2.5
16	0.57	(24)	0.38	(16)	26	13	40.9	26.5	3.9	33.3	2.5
17	6.24	(169)	4.10	(111)	283	55	41.5	10.3	2.4	33.8	2.4
18	7.98	(189)	5.07	(120)	349	65	42.9	10.2	1.1	34.3	2.4
19	5.65	(215)	3.57	(136)	246	43	43.1	9.6	0.5	34.8	2.4
21	2.27	(96)	1.42	(60)	98	26	43.6	14.5	0.4	35.0	2.4
20	2.36	(96)	1.48	(60)	102	27	43.6	14.5	0.4	35.2	2.4
22	10.59	(215)	6.35	(129)	438	79	45.4	10.3	0.1	35.8	2.4
23	5.67	(187)	3.39	(112)	234	45	45.5	11.0	0.1	36.2	2.4
24	3.88	(141)	2.28	(83)	157	35	46.3	12.9	0.0	36.5	2.4
25	12.78	(292)	7.44	(170)	513	81	46.8	9.2	0.0	37.1	2.4
26	14.54	(283)	8.12	(158)	560	92	48.8	9.9	0.0	37.7	2.3
27	6.36	(156)	3.46	(85)	239	53	50.0	13.6	0.0	38.0	2.3
28	13.69	(278)	7.44	(151)	512	86	50.2	10.3	0.0	38.6	2.3
29	8.50	(230)	4.47	(121)	308	57	51.8	11.8	0.0	39.1	2.3
30	4.19	(85)	2.17	(44)	149	45	52.6	19.7	0.0	39.2	2.3
31	11.54	(205)	5.97	(106)	411	82	52.7	12.8	0.0	39.6	2.4
32	11.62	(236)	6.01	(122)	414	77	52.7	11.9	0.0	40.1	2.4
33	19.03	(322)	9.81	(166)	676	108	52.8	10.3	0.0	40.6	2.4
34	8.63	(219)	4.41	(112)	304	59	53.3	12.6	0.0	41.0	2.4
36	5.25	(160)	2.63	(80)	181	41	54.5	15.1	0.0	41.3	2.4
35	6.93	(170)	3.46	(85)	239	53	54.5	14.6	0.0	41.5	2.4
37	9.11	(239)	4.54	(119)	313	59	54.7	12.5	0.0	41.9	2.4
38	4.59	(167)	2.28	(83)	157	35	54.8	14.9	0.0	42.1	2.4
39	10.50	(231)	5.18	(114)	357	68	55.2	12.8	0.0	42.5	2.4
40	2.30	(78)	1.12	(38)	77	25	55.9	22.2	0.0	42.6	2.4
41	7.83	(212)	3.58	(97)	247	51	59.5	14.8	0.0	43.0	2.4
42	13.00	(264)	5.86	(119)	404	76	60.4	13.6	0.0	43.4	2.4
43	5.47	(162)	2.30	(68)	158	39	64.8	18.9	0.0	43.7	2.4
44	11.65	(266)	4.77	(109)	329	64	66.4	15.3	0.0	44.2	2.4
45	13.11	(233)	5.35	(95)	368	77	66.7	16.5	0.0	44.6	2.4
46	7.51	(286)	3.05	(116)	210	40	67.1	15.0	0.0	45.2	2.4
47	10.82	(183)	4.20	(71)	289	70	70.1	19.8	0.0	45.5	2.4
48	5.21	(150)	1.70	(49)	117	34	83.2	27.6	0.0	45.9	2.4
49	7.96	(202)	2.32	(59)	160	42	93.0	27.8	0.0	46.4	2.5
50	9.93	(294)	2.74	(81)	189	43	98.5	25.0	0.0	47.2	2.5
51	4.45	(128)	1.22	(35)	84	29	99.3	38.1	0.0	47.5	2.5
52	11.25	(257)	2.80	(64)	193	49	108.9	30.7	0.0	48.3	2.5
53	16.77	(227)	3.69	(50)	255	73	123.0	38.7	0.0	48.9	2.6
54	7.13	(187)	1.53	(40)	105	34	126.6	44.4	0.0	49.5	2.6
55	4.96	(130)	0.69	(18)	47	22	194.6	98.2	0.0	50.0	2.6
POOLED	6.87	(10171)	3.75	(5545)	258	12			0.0	50.0	2.6
MEAN AGE (using grain ratios)										56.7	8.4

Date, Time: 01-15-1991 09:29:22 Filename: DOSE.FTZ
Lab# ZD7 Field# V441 Needles-Gray Wolf, Sunny Brook Meadows Vance 11/17/89
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	5.48	(190)	6.11	(212)	41	2.03	1.040	4.70	27.8	5.7
2	7.26	(172)	7.13	(169)	28	2.03	1.040	4.70	31.6	7.0
3	6.81	(167)	6.56	(161)	29	2.03	1.040	4.70	32.2	7.3
4	6.88	(192)	6.34	(177)	33	2.03	1.040	4.70	33.7	7.2
5	6.11	(155)	5.28	(134)	30	2.03	1.040	4.70	35.9	8.6
6	11.96	(172)	10.01	(144)	17	2.03	1.040	4.70	37.1	8.6
7	5.65	(153)	4.73	(128)	32	2.03	1.040	4.70	37.1	9.1
8	9.42	(231)	7.50	(184)	29	2.03	1.040	4.70	39.0	7.9
9	6.79	(201)	5.37	(159)	35	2.03	1.040	4.70	39.2	8.5
10	6.74	(171)	5.16	(131)	30	2.03	1.040	4.70	40.5	9.6
11	10.84	(220)	8.27	(168)	24	2.03	1.040	4.70	40.6	8.5
12	10.53	(187)	7.88	(140)	21	2.03	1.040	4.70	41.4	9.5
13	11.95	(182)	8.67	(132)	18	2.03	1.040	4.70	42.8	10.0
14	8.00	(203)	5.71	(145)	30	2.03	1.040	4.70	43.4	9.7
15	9.71	(230)	6.50	(154)	28	2.03	1.040	4.70	46.3	9.9
16	12.72	(269)	8.94	(189)	25	2.03	1.040	4.70	44.1	8.6
17	11.41	(193)	7.98	(135)	20	2.03	1.040	4.70	44.3	10.2
18	8.27	(210)	5.63	(143)	30	2.03	1.040	4.70	45.5	10.1
19	9.79	(290)	6.65	(197)	35	2.03	1.040	4.70	45.7	8.7
20	11.14	(198)	7.26	(129)	21	2.03	1.040	4.70	47.6	11.0
21	8.06	(191)	5.23	(124)	28	2.03	1.040	4.70	47.8	11.2
22	13.54	(252)	8.76	(163)	22	2.03	1.040	4.70	47.9	9.9
23	11.15	(217)	6.94	(135)	23	2.03	1.040	4.70	49.8	11.2
24	4.08	(100)	2.49	(61)	29	2.03	1.040	4.70	50.8	16.7
25	8.82	(209)	5.19	(123)	28	2.03	1.040	4.70	52.7	12.2
26	18.79	(318)	10.87	(184)	20	2.03	1.040	4.70	53.6	10.2
27	6.02	(168)	3.47	(97)	33	2.03	1.040	4.70	53.7	13.9
28	8.95	(212)	5.15	(122)	28	2.03	1.040	4.70	53.9	12.5
29	8.42	(171)	4.83	(98)	24	2.03	1.040	4.70	54.1	13.9
30	7.01	(166)	4.01	(95)	28	2.03	1.040	4.70	54.2	14.2
31	16.61	(253)	9.39	(143)	18	2.03	1.040	4.70	54.8	11.8
32	13.81	(257)	7.74	(144)	22	2.03	1.040	4.70	55.3	11.8
33	13.49	(194)	7.51	(108)	17	2.03	1.040	4.70	55.7	13.6
34	13.40	(272)	7.44	(151)	24	2.03	1.040	4.70	55.8	11.6
35	13.62	(242)	7.49	(133)	21	2.03	1.040	4.70	56.4	12.5
36	10.10	(205)	5.52	(112)	24	2.03	1.040	4.70	56.7	13.6
37	10.22	(242)	5.53	(131)	28	2.03	1.040	4.70	57.2	12.7
38	3.61	(122)	1.95	(66)	40	2.03	1.040	4.70	57.3	17.7
39	19.13	(259)	10.27	(139)	16	2.03	1.040	4.70	57.7	12.4
40	10.47	(186)	5.57	(99)	21	2.03	1.040	4.70	58.2	14.7
41	15.44	(222)	8.14	(117)	17	2.03	1.040	4.70	58.8	13.7
42	8.19	(194)	4.31	(102)	28	2.03	1.040	4.70	58.9	14.7
43	12.30	(229)	6.45	(120)	22	2.03	1.040	4.70	59.1	13.6
44	2.99	(81)	1.51	(41)	32	2.03	1.040	4.70	61.2	23.6
45	9.51	(193)	4.73	(96)	24	2.03	1.040	4.70	62.3	15.8
46	17.47	(266)	8.41	(128)	18	2.03	1.040	4.70	64.4	14.2
47	10.93	(259)	5.32	(126)	28	2.03	1.040	4.70	63.7	14.1
48	22.83	(309)	10.56	(143)	16	2.03	1.040	4.70	66.9	13.9
49	14.09	(286)	6.40	(130)	24	2.03	1.040	4.70	68.1	14.8
50	11.68	(247)	5.25	(111)	25	2.03	1.040	4.70	68.9	16.1

Date, Time: 01-15-1991 09:29:22 Filename: DOSE.FTZ
Lab# ZD7 Field# V441 Needles-Gray Wolf, Sunny Brook Meadows Vance 11/17/89
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
51	8.32	(183)	3.50	(77)	26	2.03	1.040	4.70	73.5	20.3
52	8.70	(206)	3.12	(74)	28	2.03	1.040	4.70	86.1	23.7
53	19.41	(312)	6.84	(110)	19	2.03	1.040	4.70	87.7	19.9
54	6.77	(166)	2.28	(56)	29	2.03	1.040	4.70	91.6	28.6
55	6.41	(141)	2.00	(44)	26	2.03	1.040	4.70	99.0	34.5
56	13.96	(189)	3.62	(49)	16	2.03	1.040	4.70	118.9	38.5
57	14.25	(229)	3.24	(52)	19	2.03	1.040	4.70	135.6	42.2
58	27.68	(281)	3.64	(37)	12	2.03	1.040	4.70	232.1	81.9
59	15.66	(212)	1.92	(26)	16	2.03	1.040	4.70	248.9	104.1
60	24.35	(309)	1.89	(24)	15	2.03	1.040	4.70	388.7	165.8

Date, Time: 01-15-1991 09:29:22 Filename: DOSE.FTZ
Lab# ZD7 Field# V441 Needles-Gray Wolf, Sunny Brook Meadows Vance 11/17/89
Number of grains = 60
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	5.48	(190)	6.11	(212)	370	54	27.8	5.7	100.0	27.8	5.7
2	7.26	(172)	7.13	(169)	432	70	31.6	7.0	38.8	29.5	4.5
3	6.81	(167)	6.56	(161)	398	65	32.2	7.3	55.4	30.3	4.0
4	6.88	(192)	6.34	(177)	384	61	33.7	7.2	58.3	31.1	3.6
5	6.11	(155)	5.28	(134)	320	57	35.9	8.6	53.0	31.9	3.4
6	11.96	(172)	10.01	(144)	607	105	37.1	8.6	45.5	32.6	3.3
7	5.65	(153)	4.73	(128)	286	52	37.1	9.1	45.7	33.1	3.2
8	9.42	(231)	7.50	(184)	454	70	39.0	7.9	33.3	34.0	3.0
9	6.79	(201)	5.37	(159)	325	54	39.2	8.5	29.0	34.5	3.0
10	6.74	(171)	5.16	(131)	313	57	40.5	9.6	25.0	35.0	2.9
11	10.84	(220)	8.27	(168)	501	81	40.6	8.5	20.7	35.6	2.9
12	10.53	(187)	7.88	(140)	477	84	41.4	9.5	17.9	36.0	2.8
13	11.95	(182)	8.67	(132)	525	95	42.8	10.0	14.1	36.4	2.8
14	8.00	(203)	5.71	(145)	346	60	43.4	9.7	10.3	36.9	2.8
16	12.72	(269)	8.94	(189)	541	83	44.1	8.6	6.0	37.5	2.7
17	11.41	(193)	7.98	(135)	483	86	44.3	10.2	4.8	37.8	2.7
18	8.27	(210)	5.63	(143)	341	59	45.5	10.1	3.2	38.3	2.7
19	9.79	(290)	6.65	(197)	403	60	45.7	8.7	1.8	38.8	2.7
15	9.71	(230)	6.50	(154)	394	66	46.3	9.9	1.2	39.2	2.7
20	11.14	(198)	7.26	(129)	440	80	47.6	11.0	0.8	39.5	2.6
21	8.06	(191)	5.23	(124)	317	59	47.8	11.2	0.5	39.8	2.6
22	13.54	(252)	8.76	(163)	531	87	47.9	9.9	0.3	40.2	2.6
23	11.15	(217)	6.94	(135)	420	75	49.8	11.2	0.1	40.6	2.6
24	4.08	(100)	2.49	(61)	151	39	50.8	16.7	0.1	40.7	2.6
25	8.82	(209)	5.19	(123)	315	59	52.7	12.2	0.0	41.1	2.6
26	18.79	(318)	10.87	(184)	659	102	53.6	10.2	0.0	41.7	2.6
27	6.02	(168)	3.47	(97)	211	44	53.7	13.9	0.0	42.0	2.6
28	8.95	(212)	5.15	(122)	312	58	53.9	12.5	0.0	42.4	2.6
29	8.42	(171)	4.83	(98)	292	61	54.1	13.9	0.0	42.6	2.6
30	7.01	(166)	4.01	(95)	243	51	54.2	14.2	0.0	42.9	2.6
31	16.61	(253)	9.39	(143)	569	99	54.8	11.8	0.0	43.3	2.6
32	13.81	(257)	7.74	(144)	469	81	55.3	11.8	0.0	43.6	2.7
33	13.49	(194)	7.51	(108)	455	90	55.7	13.6	0.0	43.9	2.7
34	13.40	(272)	7.44	(151)	451	76	55.8	11.6	0.0	44.3	2.7
35	13.62	(242)	7.49	(133)	454	82	56.4	12.5	0.0	44.6	2.7
36	10.10	(205)	5.52	(112)	334	65	56.7	13.6	0.0	44.9	2.7
37	10.22	(242)	5.53	(131)	335	61	57.2	12.7	0.0	45.2	2.7
38	3.61	(122)	1.95	(66)	118	30	57.3	17.7	0.0	45.3	2.7
39	19.13	(259)	10.27	(139)	622	110	57.7	12.4	0.0	45.6	2.7
40	10.47	(186)	5.57	(99)	338	70	58.2	14.7	0.0	45.9	2.7
41	15.44	(222)	8.14	(117)	493	94	58.8	13.7	0.0	46.1	2.7
42	8.19	(194)	4.31	(102)	261	53	58.9	14.7	0.0	46.4	2.7
43	12.30	(229)	6.45	(120)	391	74	59.1	13.6	0.0	46.6	2.7
44	2.99	(81)	1.51	(41)	92	29	61.2	23.6	0.0	46.7	2.7
45	9.51	(193)	4.73	(96)	286	60	62.3	15.8	0.0	47.0	2.7
47	10.93	(259)	5.32	(126)	322	59	63.7	14.1	0.0	47.3	2.7
46	17.47	(266)	8.41	(128)	509	93	64.4	14.2	0.0	47.7	2.7
48	22.83	(309)	10.56	(143)	640	111	66.9	13.9	0.0	48.1	2.7
49	14.09	(286)	6.40	(130)	388	70	68.1	14.8	0.0	48.5	2.7
50	11.68	(247)	5.25	(111)	318	62	68.9	16.1	0.0	48.8	2.8

Date, Time: 01-15-1991 09:29:22 Filename: DOSE.FTZ
Lab# ZD7 Field# V441 Needles-Gray Wolf, Sunny Brook Meadows Vance 11/17/89
Number of grains = 60
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
51	8.32	(183)	3.50	(77)	212	49	73.5	20.3	0.0	49.1	2.8
52	8.70	(206)	3.12	(74)	189	45	86.1	23.7	0.0	49.5	2.8
53	19.41	(312)	6.84	(110)	415	81	87.7	19.9	0.0	50.1	2.8
54	6.77	(166)	2.28	(56)	138	38	91.6	28.6	0.0	50.4	2.8
55	6.41	(141)	2.00	(44)	121	37	99.0	34.5	0.0	50.8	2.8
56	13.96	(189)	3.62	(49)	219	64	118.9	38.5	0.0	51.2	2.9
57	14.25	(229)	3.24	(52)	196	55	135.6	42.2	0.0	51.8	2.9
58	27.68	(281)	3.64	(37)	221	73	232.1	81.9	0.0	52.8	2.9
59	15.66	(212)	1.92	(26)	116	46	248.9	104.1	0.0	53.5	3.0
60	24.35	(309)	1.89	(24)	115	47	388.7	165.8	0.0	54.7	3.0
POOLED	10.10	(12736)	5.73	(7222)	347	18			0.0	54.7	3.0
MEAN AGE (using grain ratios)										68.2	15.4

Date, Time: 01-15-1991 09:29:33 Filename: ARC88-11.FTZ
Lab# ZD33 Field# ARC88-11 Needles-Gray Wolf Assem., Tyler Pk, Vance 10/31/90
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	12.50	(201)	12.75	(205)	19	1.77	0.905	4.10	26.5	5.4
2	12.12	(164)	10.27	(139)	16	1.77	0.905	4.10	31.9	7.5
3	16.78	(284)	13.77	(233)	20	1.77	0.905	4.10	32.9	6.0
4	16.82	(185)	13.09	(144)	13	1.77	0.905	4.10	34.7	7.8
5	25.04	(339)	18.40	(249)	16	1.77	0.905	4.10	36.8	6.3
6	6.80	(138)	4.73	(96)	24	1.77	0.905	4.10	38.8	10.4
7	7.38	(156)	4.96	(105)	25	1.77	0.905	4.10	40.1	10.3
8	10.01	(237)	6.59	(156)	28	1.77	0.905	4.10	41.0	8.6
9	9.16	(186)	6.01	(122)	24	1.77	0.905	4.10	41.2	9.7
10	18.28	(232)	11.98	(152)	15	1.77	0.905	4.10	41.2	8.8
11	14.68	(298)	9.26	(188)	24	1.77	0.905	4.10	42.8	8.2
12	16.70	(226)	10.49	(142)	16	1.77	0.905	4.10	43.0	9.4
13	12.50	(296)	7.73	(183)	28	1.77	0.905	4.10	43.7	8.4
14	24.43	(310)	14.89	(189)	15	1.77	0.905	4.10	44.3	8.4
15	23.22	(334)	13.77	(198)	17	1.77	0.905	4.10	45.5	8.4
16	19.58	(265)	11.52	(156)	16	1.77	0.905	4.10	45.8	9.4
17	16.49	(279)	9.57	(162)	20	1.77	0.905	4.10	46.5	9.4
18	15.42	(300)	8.84	(172)	23	1.77	0.905	4.10	47.1	9.2
19	10.93	(222)	6.25	(127)	24	1.77	0.905	4.10	47.2	10.7
20	14.35	(267)	7.41	(138)	22	1.77	0.905	4.10	52.2	11.2
21	12.56	(255)	6.30	(128)	24	1.77	0.905	4.10	53.7	11.8
22	10.39	(290)	5.09	(142)	33	1.77	0.905	4.10	55.1	11.5
23	13.53	(309)	6.44	(147)	27	1.77	0.905	4.10	56.7	11.6
24	5.50	(121)	2.55	(56)	26	1.77	0.905	4.10	58.3	19.0
25	9.85	(175)	4.50	(80)	21	1.77	0.905	4.10	59.0	16.1
26	14.01	(320)	6.35	(145)	27	1.77	0.905	4.10	59.5	12.2
27	20.75	(316)	9.13	(139)	18	1.77	0.905	4.10	61.3	12.7
28	12.31	(177)	5.15	(74)	17	1.77	0.905	4.10	64.5	18.0
29	10.20	(276)	4.17	(113)	32	1.77	0.905	4.10	65.8	14.9
30	10.68	(244)	4.33	(99)	27	1.77	0.905	4.10	66.4	16.1
31	21.04	(267)	8.51	(108)	15	1.77	0.905	4.10	66.6	15.4
32	16.72	(297)	6.75	(120)	21	1.77	0.905	4.10	66.7	14.7
33	26.28	(289)	10.46	(115)	13	1.77	0.905	4.10	67.7	15.2
34	19.24	(293)	7.55	(115)	18	1.77	0.905	4.10	68.6	15.4
35	20.19	(410)	7.83	(159)	24	1.77	0.905	4.10	69.5	13.3
36	26.85	(318)	10.13	(120)	14	1.77	0.905	4.10	71.4	15.6
37	9.15	(178)	3.19	(62)	23	1.77	0.905	4.10	77.3	23.0
38	18.98	(289)	6.57	(100)	18	1.77	0.905	4.10	77.8	18.3
39	17.98	(289)	5.85	(94)	19	1.77	0.905	4.10	82.7	19.9
40	20.92	(354)	6.80	(115)	20	1.77	0.905	4.10	82.8	18.1
41	19.76	(234)	6.33	(75)	14	1.77	0.905	4.10	84.0	22.5
42	12.54	(191)	4.01	(61)	18	1.77	0.905	4.10	84.3	25.0
43	28.52	(386)	9.01	(122)	16	1.77	0.905	4.10	85.1	18.0
44	32.39	(274)	9.57	(81)	10	1.77	0.905	4.10	91.0	23.3
45	10.98	(260)	3.17	(75)	28	1.77	0.905	4.10	93.2	24.7
46	11.19	(265)	3.08	(73)	28	1.77	0.905	4.10	97.6	26.1
47	16.68	(254)	4.14	(63)	18	1.77	0.905	4.10	108.3	30.8
48	7.09	(186)	1.68	(44)	31	1.77	0.905	4.10	113.5	38.3
49	34.48	(350)	7.58	(77)	12	1.77	0.905	4.10	122.0	31.1
50	13.22	(179)	1.92	(26)	16	1.77	0.905	4.10	183.8	77.5

Date, Time: 01-15-1991 09:29:33 Filename: ARC88-11.FTZ
Lab# ZD33 Field# ARC88-11 Needles-Gray Wolf Assem., Tyler Pk, Vance 10/31/90
Number of grains = 50
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	12.50	(201)	12.75	(205)	887	129	26.5	5.4	100.0	26.5	5.4
2	12.12	(164)	10.27	(139)	714	125	31.9	7.5	22.4	28.7	4.5
3	16.78	(284)	13.77	(233)	958	132	32.9	6.0	23.3	30.4	3.7
4	16.82	(185)	13.09	(144)	911	156	34.7	7.8	25.6	31.3	3.4
5	25.04	(339)	18.40	(249)	1280	170	36.8	6.3	14.4	32.7	3.1
6	6.80	(138)	4.73	(96)	329	68	38.8	10.4	13.6	33.2	3.1
7	7.38	(156)	4.96	(105)	345	69	40.1	10.3	10.7	33.8	3.0
8	10.01	(237)	6.59	(156)	458	76	41.0	8.6	6.0	34.7	2.9
9	9.16	(186)	6.01	(122)	418	78	41.2	9.7	4.9	35.2	2.9
10	18.28	(232)	11.98	(152)	833	139	41.2	8.8	4.0	35.8	2.8
11	14.68	(298)	9.26	(188)	644	98	42.8	8.2	2.1	36.5	2.7
12	16.70	(226)	10.49	(142)	730	126	43.0	9.4	1.7	37.0	2.7
13	12.50	(296)	7.73	(183)	537	82	43.7	8.4	1.1	37.6	2.6
14	24.43	(310)	14.89	(189)	1036	157	44.3	8.4	0.7	38.1	2.6
15	23.22	(334)	13.77	(198)	958	142	45.5	8.4	0.3	38.7	2.6
16	19.58	(265)	11.52	(156)	802	133	45.8	9.4	0.2	39.1	2.5
17	16.49	(279)	9.57	(162)	666	108	46.5	9.4	0.1	39.6	2.5
18	15.42	(300)	8.84	(172)	615	97	47.1	9.2	0.1	40.0	2.5
19	10.93	(222)	6.25	(127)	435	79	47.2	10.7	0.1	40.3	2.5
20	14.35	(267)	7.41	(138)	516	90	52.2	11.2	0.0	40.8	2.5
21	12.56	(255)	6.30	(128)	439	80	53.7	11.8	0.0	41.3	2.5
22	10.39	(290)	5.09	(142)	354	61	55.1	11.5	0.0	41.8	2.5
23	13.53	(309)	6.44	(147)	448	76	56.7	11.6	0.0	42.4	2.5
24	5.50	(121)	2.55	(56)	177	48	58.3	19.0	0.0	42.7	2.5
25	9.85	(175)	4.50	(80)	313	71	59.0	16.1	0.0	43.0	2.5
26	14.01	(320)	6.35	(145)	442	76	59.5	12.2	0.0	43.6	2.5
27	20.75	(316)	9.13	(139)	635	111	61.3	12.7	0.0	44.2	2.5
28	12.31	(177)	5.15	(74)	358	85	64.5	18.0	0.0	44.6	2.5
29	10.20	(276)	4.17	(113)	290	56	65.8	14.9	0.0	45.1	2.5
30	10.68	(244)	4.33	(99)	302	62	66.4	16.1	0.0	45.6	2.6
31	21.04	(267)	8.51	(108)	592	117	66.6	15.4	0.0	46.1	2.6
32	16.72	(297)	6.75	(120)	470	88	66.7	14.7	0.0	46.7	2.6
33	26.28	(289)	10.46	(115)	727	139	67.7	15.2	0.0	47.2	2.6
34	19.24	(293)	7.55	(115)	525	100	68.6	15.4	0.0	47.7	2.6
35	20.19	(410)	7.83	(159)	545	89	69.5	13.3	0.0	48.4	2.6
36	26.85	(318)	10.13	(120)	705	132	71.4	15.6	0.0	48.9	2.6
37	9.15	(178)	3.19	(62)	222	57	77.3	23.0	0.0	49.3	2.6
38	18.98	(289)	6.57	(100)	457	93	77.8	18.3	0.0	49.8	2.7
39	17.98	(289)	5.85	(94)	407	86	82.7	19.9	0.0	50.4	2.7
40	20.92	(354)	6.80	(115)	473	90	82.8	18.1	0.0	51.1	2.7
41	19.76	(234)	6.33	(75)	441	103	84.0	22.5	0.0	51.5	2.7
42	12.54	(191)	4.01	(61)	279	72	84.3	25.0	0.0	51.9	2.7
43	28.52	(386)	9.01	(122)	627	116	85.1	18.0	0.0	52.6	2.7
44	32.39	(274)	9.57	(81)	666	151	91.0	23.3	0.0	53.1	2.8
45	10.98	(260)	3.17	(75)	220	52	93.2	24.7	0.0	53.6	2.8
46	11.19	(265)	3.08	(73)	214	51	97.6	26.1	0.0	54.2	2.8
47	16.68	(254)	4.14	(63)	288	73	108.3	30.8	0.0	54.7	2.8
48	7.09	(186)	1.68	(44)	117	36	113.5	38.3	0.0	55.2	2.8
49	34.48	(350)	7.58	(77)	528	122	122.0	31.1	0.0	56.0	2.9
50	13.22	(179)	1.92	(26)	134	53	183.8	77.5	0.0	56.5	2.9
POOLED	14.84	(12965)	7.08	(6184)	492	24			0.0	56.5	2.9
MEAN AGE (using grain ratios)										64.4	8.5

Date, Time: 01-15-1991 09:29:46 Filename: SKOKOM.FTZ
Lab# ZD4 Field# V240 prob. Needles-Gray Wolf, Skokomish R. Vance 12/17/88
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	6.88	(198)	7.72	(222)	34	2.03	1.040	5.30	27.7	5.6
2	15.91	(350)	17.59	(387)	26	2.03	1.040	5.30	28.1	4.4
3	5.94	(201)	6.41	(217)	40	2.03	1.040	5.30	28.8	5.8
4	6.54	(166)	6.93	(176)	30	2.03	1.040	5.30	29.3	6.5
5	5.23	(155)	5.34	(158)	35	2.03	1.040	5.30	30.5	7.1
6	15.46	(314)	15.61	(317)	24	2.03	1.040	5.30	30.8	5.2
7	4.39	(130)	4.42	(131)	35	2.03	1.040	5.30	30.8	7.8
8	11.78	(289)	11.41	(280)	29	2.03	1.040	5.30	32.0	5.6
9	11.51	(292)	10.95	(278)	30	2.03	1.040	5.30	32.6	5.7
10	9.85	(200)	9.21	(187)	24	2.03	1.040	5.30	33.2	7.0
11	10.13	(240)	8.44	(200)	28	2.03	1.040	5.30	37.2	7.4
12	8.19	(194)	6.75	(160)	28	2.03	1.040	5.30	37.6	8.3
13	9.25	(266)	7.16	(206)	34	2.03	1.040	5.30	40.1	7.7
14	7.42	(201)	5.65	(153)	32	2.03	1.040	5.30	40.8	9.0
15	11.74	(298)	8.83	(224)	30	2.03	1.040	5.30	41.3	7.6
16	7.70	(228)	5.78	(171)	35	2.03	1.040	5.30	41.4	8.7
17	7.25	(184)	5.44	(138)	30	2.03	1.040	5.30	41.4	9.6
18	7.59	(212)	5.48	(153)	33	2.03	1.040	5.30	43.0	9.4
19	17.58	(238)	12.56	(170)	16	2.03	1.040	5.30	43.4	9.0
20	16.29	(248)	11.43	(174)	18	2.03	1.040	5.30	44.2	9.1
21	13.49	(251)	9.40	(175)	22	2.03	1.040	5.30	44.5	9.1
22	11.17	(274)	7.58	(186)	29	2.03	1.040	5.30	45.7	9.0
23	7.65	(207)	5.17	(140)	32	2.03	1.040	5.30	45.9	10.3
24	20.91	(283)	13.15	(178)	16	2.03	1.040	5.30	49.3	9.8
25	11.05	(215)	6.78	(132)	23	2.03	1.040	5.30	50.5	11.5
26	7.05	(155)	3.82	(84)	26	2.03	1.040	5.30	57.2	15.8
27	16.18	(438)	8.39	(227)	32	2.03	1.040	5.30	59.8	10.3
28	8.72	(236)	4.47	(121)	32	2.03	1.040	5.30	60.4	13.9
29	18.12	(276)	8.60	(131)	18	2.03	1.040	5.30	65.2	14.3
30	10.67	(316)	4.66	(138)	35	2.03	1.040	5.30	70.9	14.9
31	7.37	(212)	3.09	(89)	34	2.03	1.040	5.30	73.7	19.0
32	8.54	(195)	3.55	(81)	27	2.03	1.040	5.30	74.5	20.1
33	3.93	(133)	1.48	(50)	40	2.03	1.040	5.30	82.3	27.6
34	7.97	(182)	2.98	(68)	27	2.03	1.040	5.30	82.8	23.9
35	7.68	(221)	2.19	(63)	34	2.03	1.040	5.30	108.3	31.5
36	9.62	(179)	2.63	(49)	22	2.03	1.040	5.30	112.7	36.8
37	10.64	(297)	2.87	(80)	33	2.03	1.040	5.30	114.5	29.5
38	23.81	(282)	5.83	(69)	14	2.03	1.040	5.30	126.0	34.5
39	3.50	(83)	2.83	(67)	28	1.91	0.980	4.62	36.2	12.0
40	4.28	(116)	3.29	(89)	32	1.91	0.980	4.62	38.1	10.9
41	4.73	(160)	3.34	(113)	40	1.91	0.980	4.62	41.4	10.4
42	2.59	(68)	1.83	(48)	31	1.91	0.980	4.62	41.4	15.7
43	6.65	(135)	4.28	(87)	24	1.91	0.980	4.62	45.3	12.6
44	8.34	(120)	4.66	(67)	17	1.91	0.980	4.62	52.3	16.1
45	8.32	(169)	4.48	(91)	24	1.91	0.980	4.62	54.2	14.3
46	1.34	(61)	0.70	(32)	54	1.91	0.980	4.62	55.7	24.4
47	8.56	(152)	4.05	(72)	21	1.91	0.980	4.62	61.6	17.9
48	9.50	(209)	3.68	(81)	26	1.91	0.980	4.62	75.2	20.0

Date, Time: 01-15-1991 09:29:46 Filename: SKOKOM.FTZ
Lab# ZD4 Field# V240 prob. Needles-Gray Wolf, Skokomish R. Vance 12/17/88
Number of grains = 48
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	6.88	(198)	7.72	(222)	468	67	27.7	5.6	100.0	27.7	5.6
2	15.91	(350)	17.59	(387)	1066	122	28.1	4.4	91.0	27.9	3.6
3	5.94	(201)	6.41	(217)	389	57	28.8	5.8	96.2	28.2	3.2
4	6.54	(166)	6.93	(176)	420	67	29.3	6.5	98.0	28.4	3.0
5	5.23	(155)	5.34	(158)	323	54	30.5	7.1	97.0	28.6	2.9
6	15.46	(314)	15.61	(317)	946	117	30.8	5.2	94.9	29.1	2.7
7	4.39	(130)	4.42	(131)	268	49	30.8	7.8	96.9	29.2	2.6
8	11.78	(289)	11.41	(280)	692	90	32.0	5.6	93.7	29.7	2.5
9	11.51	(292)	10.95	(278)	664	87	32.6	5.7	90.0	30.0	2.4
10	9.85	(200)	9.21	(187)	558	87	33.2	7.0	88.5	30.3	2.4
39	3.50	(83)	2.83	(67)	182	45	36.2	12.0	77.6	30.5	2.4
11	10.13	(240)	8.44	(200)	512	77	37.2	7.4	49.1	31.0	2.4
12	8.19	(194)	6.75	(160)	409	68	37.6	8.3	33.2	31.4	2.4
40	4.28	(116)	3.29	(89)	212	46	38.1	10.9	21.4	31.6	2.4
13	9.25	(266)	7.16	(206)	434	65	40.1	7.7	6.6	32.1	2.4
14	7.42	(201)	5.65	(153)	342	58	40.8	9.0	2.7	32.6	2.4
15	11.74	(298)	8.83	(224)	535	77	41.3	7.6	0.6	33.1	2.4
17	7.25	(184)	5.44	(138)	329	59	41.4	9.6	0.3	33.4	2.4
16	7.70	(228)	5.78	(171)	350	57	41.4	8.7	0.1	33.8	2.4
41	4.73	(160)	3.34	(113)	215	42	41.4	10.4	0.0	34.0	2.4
42	2.59	(68)	1.83	(48)	118	34	41.4	15.7	0.0	34.1	2.4
18	7.59	(212)	5.48	(153)	332	57	43.0	9.4	0.0	34.5	2.4
19	17.58	(238)	12.56	(170)	761	123	43.4	9.0	0.0	34.8	2.4
20	16.29	(248)	11.43	(174)	692	111	44.2	9.1	0.0	35.2	2.4
21	13.49	(251)	9.40	(175)	570	91	44.5	9.1	0.0	35.5	2.4
43	6.65	(135)	4.28	(87)	276	61	45.3	12.6	0.0	35.7	2.4
22	11.17	(274)	7.58	(186)	459	72	45.7	9.0	0.0	36.1	2.4
23	7.65	(207)	5.17	(140)	313	56	45.9	10.3	0.0	36.4	2.4
24	20.91	(283)	13.15	(178)	797	127	49.3	9.8	0.0	36.8	2.4
25	11.05	(215)	6.78	(132)	411	75	50.5	11.5	0.0	37.2	2.4
44	8.34	(120)	4.66	(67)	300	75	52.3	16.1	0.0	37.4	2.4
45	8.32	(169)	4.48	(91)	289	62	54.2	14.3	0.0	37.7	2.4
46	1.34	(61)	0.70	(32)	45	16	55.7	24.4	0.0	37.8	2.4
26	7.05	(155)	3.82	(84)	231	52	57.2	15.8	0.0	38.1	2.4
27	16.18	(438)	8.39	(227)	508	73	59.8	10.3	0.0	38.9	2.5
28	8.72	(236)	4.47	(121)	271	51	60.4	13.9	0.0	39.3	2.5
47	8.56	(152)	4.05	(72)	261	63	61.6	17.9	0.0	39.6	2.5
29	18.12	(276)	8.60	(131)	521	95	65.2	14.3	0.0	40.2	2.5
30	10.67	(316)	4.66	(138)	282	50	70.9	14.9	0.0	40.8	2.6
31	7.37	(212)	3.09	(89)	187	41	73.7	19.0	0.0	41.3	2.6
32	8.54	(195)	3.55	(81)	215	49	74.5	20.1	0.0	41.7	2.6
48	9.50	(209)	3.68	(81)	237	54	75.2	20.0	0.0	42.1	2.6
33	3.93	(133)	1.48	(50)	90	26	82.3	27.6	0.0	42.4	2.6
34	7.97	(182)	2.98	(68)	180	45	82.8	23.9	0.0	42.9	2.7
35	7.68	(221)	2.19	(63)	133	34	108.3	31.5	0.0	43.5	2.7
36	9.62	(179)	2.63	(49)	160	46	112.7	36.8	0.0	44.0	2.7
37	10.64	(297)	2.87	(80)	174	40	114.5	29.5	0.0	44.8	2.8
38	23.81	(282)	5.83	(69)	353	87	126.0	34.5	0.0	45.6	2.8
POOLED	8.74	(10229)	5.94	(6956)	360	21			0.0	45.6	2.8
MEAN AGE (using grain ratios)										53.0	7.5

Date, Time: 01-15-1991 09:30:03 Filename: BMTN.FTZ
Lab# ZD5 Field# V241 ?Needles-Gray Wolf, W of Staircase Stn., Vance 7/8/88
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	2.88	(61)	3.07	(65)	25	2.03	1.040	5.30	29.1	10.5
2	9.16	(186)	9.75	(198)	24	2.03	1.040	5.30	29.2	6.2
3	7.25	(184)	7.64	(194)	30	2.03	1.040	5.30	29.5	6.3
4	1.57	(61)	1.52	(59)	46	2.03	1.040	5.30	32.1	11.8
5	7.64	(194)	7.29	(185)	30	2.03	1.040	5.30	32.6	6.9
6	4.82	(159)	4.52	(149)	39	2.03	1.040	5.30	33.1	7.8
7	4.61	(113)	4.28	(105)	29	2.03	1.040	5.30	33.4	9.2
8	9.46	(240)	8.08	(205)	30	2.03	1.040	5.30	36.3	7.2
9	9.70	(197)	8.22	(167)	24	2.03	1.040	5.30	36.6	7.9
10	6.24	(190)	5.25	(160)	36	2.03	1.040	5.30	36.9	8.1
11	5.37	(159)	4.42	(131)	35	2.03	1.040	5.30	37.7	9.1
12	13.24	(336)	10.44	(265)	30	2.03	1.040	5.30	39.3	6.8
13	5.15	(157)	3.91	(119)	36	2.03	1.040	5.30	40.9	10.2
14	7.94	(188)	5.95	(141)	28	2.03	1.040	5.30	41.4	9.5
15	7.17	(182)	5.00	(127)	30	2.03	1.040	5.30	44.4	10.5
16	10.36	(263)	7.09	(180)	30	2.03	1.040	5.30	45.3	9.1
17	6.38	(162)	4.29	(109)	30	2.03	1.040	5.30	46.1	11.7
18	19.15	(243)	12.84	(163)	15	2.03	1.040	5.30	46.2	9.7
19	12.43	(284)	7.92	(181)	27	2.03	1.040	5.30	48.7	9.6
20	7.30	(142)	4.52	(88)	23	2.03	1.040	5.30	50.0	13.8
21	5.27	(156)	3.17	(94)	35	2.03	1.040	5.30	51.4	13.7
22	4.10	(111)	2.40	(65)	32	2.03	1.040	5.30	52.9	16.8
23	6.34	(118)	3.71	(69)	22	2.03	1.040	5.30	53.0	16.3
24	7.83	(265)	4.55	(154)	40	2.03	1.040	5.30	53.3	11.2
25	7.30	(179)	4.24	(104)	29	2.03	1.040	5.30	53.3	13.5
26	18.91	(240)	10.87	(138)	15	2.03	1.040	5.30	53.9	11.9
27	11.89	(181)	6.76	(103)	18	2.03	1.040	5.30	54.5	13.8
28	11.35	(240)	6.34	(134)	25	2.03	1.040	5.30	55.5	12.3
29	6.45	(131)	3.60	(73)	24	2.03	1.040	5.30	55.6	16.5
30	4.38	(115)	2.44	(64)	31	2.03	1.040	5.30	55.7	17.6
31	7.54	(204)	4.14	(112)	32	2.03	1.040	5.30	56.4	13.6
32	7.06	(227)	3.86	(124)	38	2.03	1.040	5.30	56.7	13.0
33	6.50	(176)	3.40	(92)	32	2.03	1.040	5.30	59.3	15.6
34	8.08	(205)	4.26	(108)	30	2.03	1.040	5.30	58.8	14.3
35	10.17	(241)	5.32	(126)	28	2.03	1.040	5.30	59.3	13.4
36	12.61	(224)	6.42	(114)	21	2.03	1.040	5.30	60.9	14.4
37	11.82	(320)	5.91	(160)	32	2.03	1.040	5.30	61.9	12.4
38	9.31	(197)	4.63	(98)	25	2.03	1.040	5.30	62.3	15.7
39	5.27	(156)	2.57	(76)	35	2.03	1.040	5.30	63.6	18.1
40	8.47	(215)	4.10	(104)	30	2.03	1.040	5.30	64.0	15.7
41	10.56	(277)	5.07	(133)	31	2.03	1.040	5.30	64.5	14.0
42	9.99	(186)	4.78	(89)	22	2.03	1.040	5.30	64.7	17.0
43	10.68	(271)	4.93	(125)	30	2.03	1.040	5.30	67.1	14.9
44	10.40	(264)	4.73	(120)	30	2.03	1.040	5.30	68.1	15.4
45	5.84	(168)	2.64	(76)	34	2.03	1.040	5.30	68.4	19.3
46	9.12	(216)	4.09	(97)	28	2.03	1.040	5.30	68.9	17.2
47	13.53	(229)	6.03	(102)	20	2.03	1.040	5.30	69.5	17.0
48	10.34	(245)	4.56	(108)	28	2.03	1.040	5.30	70.2	16.6
49	13.64	(277)	5.07	(103)	24	2.03	1.040	5.30	83.2	19.7

Date, Time: 01-15-1991 09:30:03 Filename: BMTN.FTZ
Lab# ZD5 Field# V241 ?Needles-Gray Wolf, W of Staircase Stn., Vance 7/8/88
Number of grains = 49
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	2.88	(61)	3.07	(65)	186	47	29.1	10.5	100.0	29.1	10.5
2	9.16	(186)	9.75	(198)	591	90	29.2	6.2	99.6	29.2	5.4
3	7.25	(184)	7.64	(194)	463	71	29.5	6.3	99.7	29.3	4.2
4	1.57	(61)	1.52	(59)	92	24	32.1	11.8	97.3	29.6	4.0
5	7.64	(194)	7.29	(185)	442	69	32.6	6.9	93.1	30.4	3.6
6	4.82	(159)	4.52	(149)	274	47	33.1	7.8	93.2	30.9	3.4
7	4.61	(113)	4.28	(105)	259	52	33.4	9.2	95.1	31.1	3.3
8	9.46	(240)	8.08	(205)	489	73	36.3	7.2	80.5	32.1	3.1
9	9.70	(197)	8.22	(167)	498	82	36.6	7.9	74.0	32.6	3.0
10	6.24	(190)	5.25	(160)	318	53	36.9	8.1	70.9	33.1	3.0
11	5.37	(159)	4.42	(131)	268	49	37.7	9.1	68.5	33.5	2.9
12	13.24	(336)	10.44	(265)	633	85	39.3	6.8	46.4	34.3	2.8
13	5.15	(157)	3.91	(119)	237	45	40.9	10.2	38.6	34.7	2.8
14	7.94	(188)	5.95	(141)	361	64	41.4	9.5	30.0	35.1	2.8
15	7.17	(182)	5.00	(127)	303	56	44.4	10.5	16.3	35.6	2.8
16	10.36	(263)	7.09	(180)	430	68	45.3	9.1	5.3	36.4	2.8
17	6.38	(162)	4.29	(109)	260	52	46.1	11.7	2.9	36.8	2.8
18	19.15	(243)	12.84	(163)	778	129	46.2	9.7	1.1	37.3	2.8
19	12.43	(284)	7.92	(181)	480	76	48.7	9.6	0.2	38.0	2.8
20	7.30	(142)	4.52	(88)	274	60	50.0	13.8	0.1	38.4	2.8
21	5.27	(156)	3.17	(94)	192	41	51.4	13.7	0.0	38.8	2.8
22	4.10	(111)	2.40	(65)	145	37	52.9	16.8	0.0	39.1	2.8
23	6.34	(118)	3.71	(69)	225	55	53.0	16.3	0.0	39.4	2.8
24	7.83	(265)	4.55	(154)	276	47	53.3	11.2	0.0	40.0	2.8
25	7.30	(179)	4.24	(104)	257	52	53.3	13.5	0.0	40.4	2.8
26	18.91	(240)	10.87	(138)	659	117	53.9	11.9	0.0	40.9	2.8
27	11.89	(181)	6.76	(103)	410	84	54.5	13.8	0.0	41.3	2.8
28	11.35	(240)	6.34	(134)	384	69	55.5	12.3	0.0	41.8	2.8
29	6.45	(131)	3.60	(73)	218	52	55.6	16.5	0.0	42.1	2.8
30	4.38	(115)	2.44	(64)	148	38	55.7	17.6	0.0	42.3	2.9
31	7.54	(204)	4.14	(112)	251	49	56.4	13.6	0.0	42.7	2.9
32	7.06	(227)	3.86	(124)	234	44	56.7	13.0	0.0	43.1	2.9
34	8.08	(205)	4.26	(108)	258	51	58.8	14.3	0.0	43.5	2.9
35	10.17	(241)	5.32	(126)	322	60	59.3	13.4	0.0	43.9	2.9
33	6.50	(176)	3.40	(92)	206	44	59.3	15.6	0.0	44.2	2.9
36	12.61	(224)	6.42	(114)	389	76	60.9	14.4	0.0	44.6	2.9
37	11.82	(320)	5.91	(160)	358	60	61.9	12.4	0.0	45.2	2.9
38	9.31	(197)	4.63	(98)	281	59	62.3	15.7	0.0	45.6	2.9
39	5.27	(156)	2.57	(76)	156	37	63.6	18.1	0.0	45.8	3.0
40	8.47	(215)	4.10	(104)	248	50	64.0	15.7	0.0	46.2	3.0
41	10.56	(277)	5.07	(133)	307	56	64.5	14.0	0.0	46.7	3.0
42	9.99	(186)	4.78	(89)	290	63	64.7	17.0	0.0	47.0	3.0
43	10.68	(271)	4.93	(125)	298	56	67.1	14.9	0.0	47.4	3.0
44	10.40	(264)	4.73	(120)	286	54	68.1	15.4	0.0	47.9	3.0
45	5.84	(168)	2.64	(76)	160	38	68.4	19.3	0.0	48.2	3.0
46	9.12	(216)	4.09	(97)	248	52	68.9	17.2	0.0	48.5	3.0
47	13.53	(229)	6.03	(102)	365	75	69.5	17.0	0.0	48.9	3.1
48	10.34	(245)	4.56	(108)	276	55	70.2	16.6	0.0	49.3	3.1
49	13.64	(277)	5.07	(103)	307	63	83.2	19.7	0.0	49.8	3.1
POOLED	8.12	(9735)	5.05	(6056)	306	18			0.0	49.8	3.1
MEAN AGE (using grain ratios)										51.8	4.7

Date, Time: 01-15-1991 09:32:47 Filename: 87727-1.FTZ
Lab# ZR17 Field# 87727-1 W. Olympic Assem., base of Humes Gl., Vance 9/7/90
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	1.04	(50)	3.03	(146)	57	1.82	0.932	5.02	9.5	3.2
2	1.12	(52)	2.84	(132)	55	1.82	0.932	5.02	11.0	3.6
3	0.77	(28)	1.90	(69)	43	1.82	0.932	5.02	11.3	5.1
4	1.90	(53)	4.55	(127)	33	1.82	0.932	5.02	11.6	3.8
5	2.36	(128)	5.60	(303)	64	1.82	0.932	5.02	11.8	2.6
6	2.27	(69)	5.32	(162)	36	1.82	0.932	5.02	11.9	3.5
7	2.54	(114)	5.91	(265)	53	1.82	0.932	5.02	12.0	2.8
8	1.39	(59)	3.12	(132)	50	1.82	0.932	5.02	12.5	3.9
9	2.26	(65)	5.01	(144)	34	1.82	0.932	5.02	12.6	3.8
10	1.64	(97)	3.61	(214)	70	1.82	0.932	5.02	12.6	3.2
11	1.74	(97)	3.64	(203)	66	1.82	0.932	5.02	13.3	3.4
12	1.40	(52)	2.87	(107)	44	1.82	0.932	5.02	13.5	4.6
13	3.58	(121)	7.33	(248)	40	1.82	0.932	5.02	13.6	3.1
14	1.24	(67)	2.53	(137)	64	1.82	0.932	5.02	13.6	4.1
15	2.60	(88)	5.26	(178)	40	1.82	0.932	5.02	13.8	3.7
16	3.20	(73)	6.44	(147)	27	1.82	0.932	5.02	13.8	4.0
17	2.40	(75)	4.76	(149)	37	1.82	0.932	5.02	14.0	4.0
18	2.66	(142)	5.29	(282)	63	1.82	0.932	5.02	14.0	3.0
19	3.55	(96)	6.65	(180)	32	1.82	0.932	5.02	14.9	3.8
20	3.65	(139)	6.65	(253)	45	1.82	0.932	5.02	15.3	3.3
21	2.60	(88)	4.58	(155)	40	1.82	0.932	5.02	15.8	4.3
22	5.09	(112)	8.82	(194)	26	1.82	0.932	5.02	16.1	3.9
23	2.98	(101)	5.14	(174)	40	1.82	0.932	5.02	16.2	4.1
24	1.47	(67)	2.45	(112)	54	1.82	0.932	5.02	16.7	5.2
25	2.36	(92)	3.88	(151)	46	1.82	0.932	5.02	17.0	4.6
26	5.47	(111)	8.96	(182)	24	1.82	0.932	5.02	17.0	4.2
27	1.62	(59)	2.64	(96)	43	1.82	0.932	5.02	17.1	5.7
28	2.81	(69)	4.48	(110)	29	1.82	0.932	5.02	17.5	5.4
29	2.71	(119)	4.21	(185)	52	1.82	0.932	5.02	17.9	4.3
30	4.14	(91)	6.18	(136)	26	1.82	0.932	5.02	18.6	5.1
31	1.26	(78)	1.83	(113)	73	1.82	0.932	5.02	19.2	5.7
32	5.16	(131)	7.45	(189)	30	1.82	0.932	5.02	19.3	4.5
33	3.00	(71)	4.26	(101)	28	1.82	0.932	5.02	19.6	6.1
34	4.73	(160)	6.62	(224)	40	1.82	0.932	5.02	19.9	4.2
35	4.31	(102)	5.87	(139)	28	1.82	0.932	5.02	20.4	5.4
36	4.41	(123)	5.30	(148)	33	1.82	0.932	5.02	23.1	5.8
37	2.27	(50)	2.73	(60)	26	1.82	0.932	5.02	23.2	9.0
38	3.89	(125)	4.60	(148)	38	1.82	0.932	5.02	23.5	5.8
39	3.24	(107)	3.79	(125)	39	1.82	0.932	5.02	23.8	6.4
40	2.82	(86)	3.15	(96)	36	1.82	0.932	5.02	24.9	7.5
41	3.07	(117)	3.34	(127)	45	1.82	0.932	5.02	25.6	6.7
42	6.35	(129)	6.35	(129)	24	1.82	0.932	5.02	27.8	7.1
43	4.73	(188)	4.58	(182)	47	1.82	0.932	5.02	28.7	6.1
44	1.64	(57)	1.56	(54)	41	1.82	0.932	5.02	29.4	11.2
45	13.72	(209)	12.67	(193)	18	1.82	0.932	5.02	30.1	6.2
46	9.41	(191)	8.42	(171)	24	1.82	0.932	5.02	31.1	6.7
47	9.46	(176)	8.22	(153)	22	1.82	0.932	5.02	32.0	7.3
48	12.74	(194)	10.31	(157)	18	1.82	0.932	5.02	34.4	7.6
49	12.66	(150)	10.13	(120)	14	1.82	0.932	5.02	34.8	8.7
50	13.48	(171)	10.48	(133)	15	1.82	0.932	5.02	35.7	8.5

Date, Time: 01-15-1991 09:32:47 Filename: 87727-1.FTZ
Lab# ZR17 Field# 87727-1 W. Olympic Assem., base of Humes Gl., Vance 9/7/90
Number of grains = 50
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	1.04	(50)	3.03	(146)	205	35	9.5	3.2	100.0	9.5	3.2
2	1.12	(52)	2.84	(132)	192	35	11.0	3.6	54.5	10.2	2.4
3	0.77	(28)	1.90	(69)	128	32	11.3	5.1	77.0	10.4	2.2
4	1.90	(53)	4.55	(127)	307	57	11.6	3.8	84.3	10.8	1.9
5	2.36	(128)	5.60	(303)	378	47	11.8	2.6	87.0	11.2	1.6
6	2.27	(69)	5.32	(162)	359	59	11.9	3.5	92.5	11.3	1.5
7	2.54	(114)	5.91	(265)	399	53	12.0	2.8	95.1	11.4	1.3
8	1.39	(59)	3.12	(132)	211	38	12.5	3.9	96.6	11.5	1.3
9	2.26	(65)	5.01	(144)	338	59	12.6	3.8	97.5	11.6	1.3
10	1.64	(97)	3.61	(214)	244	36	12.6	3.2	97.9	11.8	1.2
11	1.74	(97)	3.64	(203)	246	37	13.3	3.4	96.9	11.9	1.2
12	1.40	(52)	2.87	(107)	194	39	13.5	4.6	97.1	12.0	1.1
13	3.58	(121)	7.33	(248)	495	68	13.6	3.1	95.7	12.2	1.1
14	1.24	(67)	2.53	(137)	171	30	13.6	4.1	96.1	12.3	1.1
15	2.60	(88)	5.26	(178)	355	56	13.8	3.7	96.0	12.4	1.1
16	3.20	(73)	6.44	(147)	435	75	13.8	4.0	96.3	12.4	1.1
17	2.40	(75)	4.76	(149)	322	55	14.0	4.0	96.3	12.5	1.1
18	2.66	(142)	5.29	(282)	358	46	14.0	3.0	95.4	12.7	1.0
19	3.55	(96)	6.65	(180)	449	71	14.9	3.8	93.2	12.8	1.0
20	3.65	(139)	6.65	(253)	449	61	15.3	3.3	85.7	13.0	1.0
21	2.60	(88)	4.58	(155)	310	52	15.8	4.3	79.3	13.1	1.0
22	5.09	(112)	8.82	(194)	596	91	16.1	3.9	68.0	13.2	1.0
23	2.98	(101)	5.14	(174)	347	56	16.2	4.1	58.9	13.4	1.0
24	1.47	(67)	2.45	(112)	166	32	16.7	5.2	52.9	13.4	1.0
25	2.36	(92)	3.88	(151)	262	45	17.0	4.6	41.7	13.6	1.0
26	5.47	(111)	8.96	(182)	606	95	17.0	4.2	30.5	13.7	1.0
27	1.62	(59)	2.64	(96)	178	37	17.1	5.7	27.7	13.8	1.0
28	2.81	(69)	4.48	(110)	303	60	17.5	5.4	23.0	13.9	1.0
29	2.71	(119)	4.21	(185)	284	44	17.9	4.3	12.9	14.0	1.0
30	4.14	(91)	6.18	(136)	418	75	18.6	5.1	7.2	14.1	1.0
31	1.26	(78)	1.83	(113)	124	24	19.2	5.7	3.9	14.2	1.0
32	5.16	(131)	7.45	(189)	503	77	19.3	4.5	1.1	14.4	1.0
33	3.00	(71)	4.26	(101)	288	59	19.6	6.1	0.6	14.5	1.0
34	4.73	(160)	6.62	(224)	447	64	19.9	4.2	0.1	14.7	1.0
35	4.31	(102)	5.87	(139)	397	70	20.4	5.4	0.0	14.9	1.0
36	4.41	(123)	5.30	(148)	358	62	23.1	5.8	0.0	15.1	1.0
37	2.27	(50)	2.73	(60)	184	48	23.2	9.0	0.0	15.1	1.0
38	3.89	(125)	4.60	(148)	311	53	23.5	5.8	0.0	15.3	1.0
39	3.24	(107)	3.79	(125)	256	48	23.8	6.4	0.0	15.5	1.0
40	2.82	(86)	3.15	(96)	213	45	24.9	7.5	0.0	15.7	1.0
41	3.07	(117)	3.34	(127)	225	42	25.6	6.7	0.0	15.8	1.0
42	6.35	(129)	6.35	(129)	429	79	27.8	7.1	0.0	16.1	1.0
43	4.73	(188)	4.58	(182)	309	48	28.7	6.1	0.0	16.4	1.1
44	1.64	(57)	1.56	(54)	105	29	29.4	11.2	0.0	16.5	1.1
45	13.72	(209)	12.67	(193)	857	131	30.1	6.2	0.0	16.9	1.1
46	9.41	(191)	8.42	(171)	569	92	31.1	6.7	0.0	17.2	1.1
47	9.46	(176)	8.22	(153)	556	94	32.0	7.3	0.0	17.5	1.1
48	12.74	(194)	10.31	(157)	697	117	34.4	7.6	0.0	17.9	1.1
49	12.66	(150)	10.13	(120)	685	130	34.8	8.7	0.0	18.1	1.1
50	13.48	(171)	10.48	(133)	708	128	35.7	8.5	0.0	18.4	1.1
POOLED	3.11	(5189)	4.70	(7835)	317	17			0.0	18.4	1.1
MEAN AGE (using grain ratios)										19.1	2.2

Date, Time: 01-15-1991 09:33:02 Filename: 87716-2.FTZ
Lab# ZR9 Field# 87716-2 Western Olympic Assem., Queets Glacier Vance 4/24/90
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	0.84	(50)	3.93	(233)	70	1.87	0.959	4.28	6.2	1.9
2	1.70	(79)	5.93	(276)	55	1.87	0.959	4.28	8.2	2.1
3	1.33	(62)	3.85	(179)	55	1.87	0.959	4.28	9.9	3.0
4	2.08	(88)	5.56	(235)	50	1.87	0.959	4.28	10.7	2.7
5	1.53	(66)	4.06	(175)	51	1.87	0.959	4.28	10.8	3.2
6	0.56	(32)	1.44	(83)	68	1.87	0.959	4.28	11.0	4.6
7	3.50	(77)	8.82	(194)	26	1.87	0.959	4.28	11.4	3.1
8	1.90	(87)	4.57	(209)	54	1.87	0.959	4.28	11.9	3.1
9	2.25	(76)	5.23	(177)	40	1.87	0.959	4.28	12.3	3.4
10	2.71	(110)	6.23	(253)	48	1.87	0.959	4.28	12.5	2.9
11	2.76	(126)	6.17	(282)	54	1.87	0.959	4.28	12.8	2.8
12	3.22	(120)	7.20	(268)	44	1.87	0.959	4.28	12.8	2.9
13	3.14	(77)	6.93	(170)	29	1.87	0.959	4.28	13.0	3.6
14	3.78	(131)	8.19	(284)	41	1.87	0.959	4.28	13.2	2.8
15	1.42	(88)	3.00	(185)	73	1.87	0.959	4.28	13.6	3.6
16	2.17	(68)	4.41	(138)	37	1.87	0.959	4.28	14.1	4.2
17	3.84	(91)	7.77	(184)	28	1.87	0.959	4.28	14.2	3.7
18	1.28	(76)	2.50	(148)	70	1.87	0.959	4.28	14.7	4.2
19	3.55	(129)	6.84	(249)	43	1.87	0.959	4.28	14.8	3.3
20	1.62	(82)	3.09	(157)	60	1.87	0.959	4.28	15.0	4.1
21	1.99	(81)	3.74	(152)	48	1.87	0.959	4.28	15.3	4.3
22	3.59	(88)	6.60	(162)	29	1.87	0.959	4.28	15.6	4.2
23	3.76	(86)	6.83	(156)	27	1.87	0.959	4.28	15.8	4.3
24	5.76	(195)	10.28	(348)	40	1.87	0.959	4.28	16.1	3.0
25	2.45	(135)	4.35	(239)	65	1.87	0.959	4.28	16.2	3.6
26	3.49	(124)	6.14	(218)	42	1.87	0.959	4.28	16.3	3.7
27	4.77	(121)	8.16	(207)	30	1.87	0.959	4.28	16.7	3.9
28	2.96	(95)	5.01	(161)	38	1.87	0.959	4.28	16.9	4.4
29	6.32	(187)	10.64	(315)	35	1.87	0.959	4.28	17.0	3.2
30	3.90	(145)	6.45	(240)	44	1.87	0.959	4.28	17.3	3.7
31	2.78	(141)	4.53	(230)	60	1.87	0.959	4.28	17.6	3.8
32	2.77	(89)	4.51	(145)	38	1.87	0.959	4.28	17.6	4.8
33	5.13	(152)	8.14	(241)	35	1.87	0.959	4.28	18.1	3.8
34	3.93	(103)	6.18	(162)	31	1.87	0.959	4.28	18.2	4.7
35	3.50	(77)	5.46	(120)	26	1.87	0.959	4.28	18.4	5.4
36	6.91	(152)	9.91	(218)	26	1.87	0.959	4.28	20.0	4.3
37	1.90	(66)	2.68	(93)	41	1.87	0.959	4.28	20.3	6.6
38	11.16	(170)	15.69	(239)	18	1.87	0.959	4.28	20.4	4.2
39	5.44	(138)	7.45	(189)	30	1.87	0.959	4.28	20.9	4.8
40	4.02	(119)	5.40	(160)	35	1.87	0.959	4.28	21.3	5.2
41	2.96	(100)	3.81	(129)	40	1.87	0.959	4.28	22.2	6.0
42	7.39	(125)	9.52	(161)	20	1.87	0.959	4.28	22.2	5.4
43	9.60	(203)	11.77	(249)	25	1.87	0.959	4.28	23.3	4.5
44	3.02	(92)	3.64	(111)	36	1.87	0.959	4.28	23.7	6.8
45	6.86	(174)	8.00	(203)	30	1.87	0.959	4.28	24.5	5.2
46	3.13	(98)	3.61	(113)	37	1.87	0.959	4.28	24.8	6.9
47	5.73	(155)	6.50	(176)	32	1.87	0.959	4.28	25.2	5.7
48	4.43	(135)	4.50	(137)	36	1.87	0.959	4.28	28.2	6.9
49	6.75	(200)	6.35	(188)	35	1.87	0.959	4.28	30.4	6.3
50	7.23	(214)	6.35	(188)	35	1.87	0.959	4.28	32.6	6.7

Date, Time: 01-15-1991 09:33:02 Filename: 87716-2.FTZ
Lab# ZR9 Field# 87716-2 Western Olympic Assem., Queets Glacier Vance 4/24/90
Number of grains = 50
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	0.84	(50)	3.93	(233)	259	36	6.2	1.9	100.0	6.2	1.9
2	1.70	(79)	5.93	(276)	390	50	8.2	2.1	15.2	7.3	1.5
3	1.33	(62)	3.85	(179)	253	39	9.9	3.0	7.9	8.0	1.3
4	2.08	(88)	5.56	(235)	365	50	10.7	2.7	3.1	8.7	1.2
5	1.53	(66)	4.06	(175)	266	42	10.8	3.2	3.1	9.0	1.2
6	0.56	(32)	1.44	(83)	95	21	11.0	4.6	4.4	9.2	1.2
7	3.50	(77)	8.82	(194)	580	87	11.4	3.1	3.7	9.5	1.1
8	1.90	(87)	4.57	(209)	301	44	11.9	3.1	2.5	9.8	1.1
9	2.25	(76)	5.23	(177)	344	54	12.3	3.4	1.9	10.0	1.0
10	2.71	(110)	6.23	(253)	409	54	12.5	2.9	1.2	10.3	1.0
11	2.76	(126)	6.17	(282)	406	51	12.8	2.8	0.7	10.6	1.0
12	3.22	(120)	7.20	(268)	473	61	12.8	2.9	0.5	10.9	0.9
13	3.14	(77)	6.93	(170)	455	73	13.0	3.6	0.6	11.0	0.9
14	3.78	(131)	8.19	(284)	538	68	13.2	2.8	0.4	11.2	0.9
15	1.42	(88)	3.00	(185)	197	30	13.6	3.6	0.4	11.4	0.9
16	2.17	(68)	4.41	(138)	290	51	14.1	4.2	0.3	11.5	0.9
17	3.84	(91)	7.77	(184)	510	78	14.2	3.7	0.2	11.6	0.9
18	1.28	(76)	2.50	(148)	164	28	14.7	4.2	0.2	11.7	0.9
19	3.55	(129)	6.84	(249)	450	60	14.8	3.3	0.1	11.9	0.9
20	1.62	(82)	3.09	(157)	203	34	15.0	4.1	0.1	12.0	0.9
21	1.99	(81)	3.74	(152)	246	41	15.3	4.3	0.0	12.2	0.9
22	3.59	(88)	6.60	(162)	434	71	15.6	4.2	0.0	12.3	0.9
23	3.76	(86)	6.83	(156)	449	74	15.8	4.3	0.0	12.4	0.9
24	5.76	(195)	10.28	(348)	676	78	16.1	3.0	0.0	12.7	0.8
25	2.45	(135)	4.35	(239)	286	39	16.2	3.6	0.0	12.8	0.8
26	3.49	(124)	6.14	(218)	403	57	16.3	3.7	0.0	13.0	0.8
27	4.77	(121)	8.16	(207)	536	78	16.7	3.9	0.0	13.1	0.8
28	2.96	(95)	5.01	(161)	329	54	16.9	4.4	0.0	13.2	0.8
29	6.32	(187)	10.64	(315)	699	84	17.0	3.2	0.0	13.4	0.8
30	3.90	(145)	6.45	(240)	424	58	17.3	3.7	0.0	13.6	0.8
31	2.78	(141)	4.53	(230)	298	41	17.6	3.8	0.0	13.7	0.8
32	2.77	(89)	4.51	(145)	296	51	17.6	4.8	0.0	13.8	0.8
33	5.13	(152)	8.14	(241)	535	73	18.1	3.8	0.0	13.9	0.8
34	3.93	(103)	6.18	(162)	406	66	18.2	4.7	0.0	14.0	0.8
35	3.50	(77)	5.46	(120)	358	67	18.4	5.4	0.0	14.1	0.8
36	6.91	(152)	9.91	(218)	651	93	20.0	4.3	0.0	14.3	0.8
37	1.90	(66)	2.68	(93)	176	37	20.3	6.6	0.0	14.4	0.8
38	11.16	(170)	15.69	(239)	1031	141	20.4	4.2	0.0	14.5	0.8
39	5.44	(138)	7.45	(189)	489	74	20.9	4.8	0.0	14.7	0.8
40	4.02	(119)	5.40	(160)	355	58	21.3	5.2	0.0	14.8	0.8
41	2.96	(100)	3.81	(129)	250	45	22.2	6.0	0.0	14.9	0.9
42	7.39	(125)	9.52	(161)	625	102	22.2	5.4	0.0	15.1	0.9
43	9.60	(203)	11.77	(249)	774	103	23.3	4.5	0.0	15.3	0.9
44	3.02	(92)	3.64	(111)	239	47	23.7	6.8	0.0	15.4	0.9
45	6.86	(174)	8.00	(203)	526	77	24.5	5.2	0.0	15.6	0.9
46	3.13	(98)	3.61	(113)	237	46	24.8	6.9	0.0	15.8	0.9
47	5.73	(155)	6.50	(176)	427	67	25.2	5.7	0.0	15.9	0.9
48	4.43	(135)	4.50	(137)	296	52	28.2	6.9	0.0	16.1	0.9
49	6.75	(200)	6.35	(188)	417	63	30.4	6.3	0.0	16.4	0.9
50	7.23	(214)	6.35	(188)	417	63	32.6	6.7	0.0	16.7	0.9
POOLED	3.26	(5675)	5.58	(9729)	367	17			0.0	16.7	0.9
MEAN AGE (using grain ratios)										17.1	1.7

Date, Time: 01-15-1991 09:33:19 Filename: 8887-1.FTZ
Lab# ZR46, Field# 8887-1 Grand Valley Assem., W of Hayden Pass, Vance 8/10/90
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	1.97	(75)	5.65	(215)	45	1.80	0.921	4.28	9.6	2.6
2	1.50	(76)	4.02	(204)	60	1.80	0.921	4.28	10.3	2.8
3	2.00	(78)	5.32	(207)	46	1.80	0.921	4.28	10.4	2.8
4	5.04	(128)	11.11	(282)	30	1.80	0.921	4.28	12.5	2.7
5	3.28	(111)	6.94	(235)	40	1.80	0.921	4.28	13.0	3.0
6	3.16	(99)	6.55	(205)	37	1.80	0.921	4.28	13.3	3.3
7	3.71	(113)	7.62	(232)	36	1.80	0.921	4.28	13.4	3.1
8	6.12	(207)	12.50	(423)	40	1.80	0.921	4.28	13.5	2.4
9	2.52	(96)	5.07	(193)	45	1.80	0.921	4.28	13.7	3.5
10	2.93	(99)	5.82	(197)	40	1.80	0.921	4.28	13.8	3.5
11	3.48	(103)	6.62	(196)	35	1.80	0.921	4.28	14.5	3.6
12	3.36	(159)	6.35	(301)	56	1.80	0.921	4.28	14.5	2.9
13	4.82	(200)	8.08	(335)	49	1.80	0.921	4.28	16.4	3.0
14	3.81	(100)	6.22	(163)	31	1.80	0.921	4.28	16.9	4.4
15	4.14	(112)	6.69	(181)	32	1.80	0.921	4.28	17.0	4.2
16	1.61	(64)	2.51	(100)	47	1.80	0.921	4.28	17.6	5.7
17	5.52	(154)	8.45	(236)	33	1.80	0.921	4.28	18.0	3.8
18	3.55	(117)	5.36	(177)	39	1.80	0.921	4.28	18.2	4.4
19	7.18	(170)	10.17	(241)	28	1.80	0.921	4.28	19.4	4.0
20	4.02	(119)	4.90	(145)	35	1.80	0.921	4.28	22.6	5.7

Date, Time: 01-15-1991 09:33:19 Filename: 8887-1.FTZ
Lab# ZR46, Field# 8887-1 Grand Valley Assem., W of Hayden Pass, Vance 8/10/90
Number of grains = 20
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	1.97	(75)	5.65	(215)	386	55	9.6	2.6	100.0	9.6	2.6
2	1.50	(76)	4.02	(204)	275	40	10.3	2.8	72.9	9.9	1.9
3	2.00	(78)	5.32	(207)	363	53	10.4	2.8	90.8	10.1	1.6
4	5.04	(128)	11.11	(282)	759	96	12.5	2.7	41.1	10.8	1.4
5	3.28	(111)	6.94	(235)	475	65	13.0	3.0	30.9	11.3	1.3
6	3.16	(99)	6.55	(205)	448	65	13.3	3.3	28.2	11.6	1.3
7	3.71	(113)	7.62	(232)	521	72	13.4	3.1	27.1	11.9	1.2
8	6.12	(207)	12.50	(423)	854	91	13.5	2.4	23.4	12.2	1.1
9	2.52	(96)	5.07	(193)	346	52	13.7	3.5	26.4	12.3	1.1
10	2.93	(99)	5.82	(197)	398	59	13.8	3.5	29.1	12.5	1.1
11	3.48	(103)	6.62	(196)	452	67	14.5	3.6	27.6	12.6	1.0
12	3.36	(159)	6.35	(301)	434	53	14.5	2.9	23.5	12.8	1.0
13	4.82	(200)	8.08	(335)	552	65	16.4	3.0	5.5	13.2	1.0
14	3.81	(100)	6.22	(163)	425	69	16.9	4.4	2.9	13.4	1.0
15	4.14	(112)	6.69	(181)	457	71	17.0	4.2	1.4	13.6	1.0
16	1.61	(64)	2.51	(100)	172	35	17.6	5.7	1.0	13.7	1.0
17	5.52	(154)	8.45	(236)	578	79	18.0	3.8	0.2	13.9	1.0
18	3.55	(117)	5.36	(177)	367	57	18.2	4.4	0.1	14.1	1.0
19	7.18	(170)	10.17	(241)	695	94	19.4	4.0	0.0	14.4	1.0
20	4.02	(119)	4.90	(145)	335	57	22.6	5.7	0.0	14.7	1.0
POOLED	3.50	(2380)	6.57	(4468)	449	23			0.0	14.7	1.0
MEAN AGE (using grain ratios)										14.9	1.6

Date, Time: 01-15-1991 09:33:33 Filename: 8889-1.FTZ
Lab# ZR48 Field# 8889-1 Elwha Assemblage, Mt. Fromme Vance 3/20/90
------ GRAIN AGES IN ORIGINAL ORDER ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	Squares	RhoD (10^5)	Phi (10^15)	± 2s (%)	Age (Ma)	± 2s
1	4.50	(137)	11.00	(335)	36	1.87	0.956	4.68	11.7	2.4
2	2.39	(91)	5.81	(221)	45	1.87	0.956	4.68	11.8	3.0
3	2.20	(91)	5.31	(220)	49	1.87	0.956	4.68	11.8	3.0
4	3.55	(111)	7.89	(247)	37	1.87	0.956	4.68	12.8	3.0
5	3.82	(113)	8.34	(247)	35	1.87	0.956	4.68	13.1	3.0
6	2.99	(114)	6.51	(248)	45	1.87	0.956	4.68	13.1	3.0
7	3.93	(113)	8.41	(242)	34	1.87	0.956	4.68	13.3	3.1
8	4.59	(101)	9.64	(212)	26	1.87	0.956	4.68	13.6	3.4
9	4.54	(96)	9.46	(200)	25	1.87	0.956	4.68	13.7	3.5
10	4.64	(106)	9.54	(218)	27	1.87	0.956	4.68	13.9	3.4
11	5.23	(208)	10.74	(427)	47	1.87	0.956	4.68	13.9	2.4
12	2.51	(68)	5.06	(137)	32	1.87	0.956	4.68	14.2	4.3
13	5.11	(108)	10.17	(215)	25	1.87	0.956	4.68	14.4	3.5
14	3.78	(80)	7.52	(159)	25	1.87	0.956	4.68	14.4	4.0
15	6.34	(134)	12.10	(256)	25	1.87	0.956	4.68	15.0	3.3
16	3.87	(108)	7.38	(206)	33	1.87	0.956	4.68	15.0	3.6
17	3.30	(92)	6.23	(174)	33	1.87	0.956	4.68	15.1	4.0
18	4.23	(161)	7.88	(300)	45	1.87	0.956	4.68	15.3	3.1
19	4.22	(132)	7.89	(247)	37	1.87	0.956	4.68	15.3	3.4
20	3.48	(150)	6.37	(275)	51	1.87	0.956	4.68	15.6	3.2
21	6.89	(169)	12.51	(307)	29	1.87	0.956	4.68	15.7	3.1
22	4.63	(196)	8.30	(351)	50	1.87	0.956	4.68	16.0	2.9
23	3.93	(133)	7.18	(243)	40	1.87	0.956	4.68	15.6	3.5
24	4.24	(129)	7.35	(224)	36	1.87	0.956	4.68	16.5	3.7
25	7.68	(182)	13.13	(311)	28	1.87	0.956	4.68	16.7	3.2
26	4.49	(95)	7.61	(161)	25	1.87	0.956	4.68	16.9	4.4
27	4.73	(124)	7.89	(207)	31	1.87	0.956	4.68	17.1	4.0
28	4.96	(218)	8.21	(361)	52	1.87	0.956	4.68	17.3	3.1
29	6.71	(159)	11.10	(263)	28	1.87	0.956	4.68	17.3	3.6
30	8.67	(132)	13.92	(212)	18	1.87	0.956	4.68	17.8	4.0
31	4.15	(144)	6.66	(231)	41	1.87	0.956	4.68	17.8	3.9
32	1.77	(63)	2.79	(99)	42	1.87	0.956	4.68	18.2	5.9
33	7.87	(193)	11.98	(294)	29	1.87	0.956	4.68	18.8	3.6
34	6.12	(145)	9.41	(223)	28	1.87	0.956	4.68	18.6	4.1
35	4.73	(140)	7.23	(214)	35	1.87	0.956	4.68	18.7	4.2
36	7.27	(160)	11.05	(243)	26	1.87	0.956	4.68	18.8	3.9
37	5.95	(146)	8.93	(219)	29	1.87	0.956	4.68	19.0	4.2
38	7.09	(168)	10.43	(247)	28	1.87	0.956	4.68	19.4	4.0
39	6.90	(140)	9.80	(199)	24	1.87	0.956	4.68	20.1	4.5
40	9.08	(192)	12.77	(270)	25	1.87	0.956	4.68	20.3	4.0
41	12.39	(241)	17.27	(336)	23	1.87	0.956	4.68	20.5	3.6
42	7.84	(146)	10.85	(202)	22	1.87	0.956	4.68	20.6	4.6
43	4.35	(81)	6.18	(115)	22	1.87	0.956	4.68	20.1	5.9
44	7.32	(130)	9.96	(177)	21	1.87	0.956	4.68	21.0	4.9
45	6.42	(152)	8.27	(196)	28	1.87	0.956	4.68	22.2	4.9
46	9.36	(190)	12.07	(245)	24	1.87	0.956	4.68	22.2	4.4
47	3.06	(88)	3.86	(111)	34	1.87	0.956	4.68	22.6	6.6
48	6.88	(163)	8.61	(204)	28	1.87	0.956	4.68	22.8	4.9
49	15.17	(154)	17.93	(182)	12	1.87	0.956	4.68	24.2	5.4
50	7.71	(176)	8.58	(196)	27	1.87	0.956	4.68	25.6	5.5

Date, Time: 01-15-1991 09:33:33 Filename: 8889-1.FTZ
Lab# ZR48 Field# 8889-1 Elwha Assemblage, Mt. Fromme Vance 3/20/90
Number of grains = 50
------ GRAIN AGES ORDERED WITH INCREASING AGE ------

Grain no.	RhoS (10^6)	(Ns)	RhoI (10^6)	(Ni)	U ± 2s (ppm)		Grain age ± 2s (Ma)		P(χ^2) (%)	Sum age ± 2s (Ma)	
1	4.50	(137)	11.00	(335)	725	86	11.7	2.4	100.0	11.7	2.4
2	2.39	(91)	5.81	(221)	382	54	11.8	3.0	96.6	11.7	1.9
3	2.20	(91)	5.31	(220)	350	50	11.8	3.0	99.7	11.8	1.7
4	3.55	(111)	7.89	(247)	520	70	12.8	3.0	92.8	12.0	1.5
5	3.82	(113)	8.34	(247)	550	75	13.1	3.0	92.5	12.2	1.4
6	2.99	(114)	6.51	(248)	429	58	13.1	3.0	94.1	12.4	1.3
7	3.93	(113)	8.41	(242)	554	76	13.3	3.1	95.2	12.5	1.2
8	4.59	(101)	9.64	(212)	635	92	13.6	3.4	95.7	12.6	1.2
9	4.54	(96)	9.46	(200)	623	93	13.7	3.5	96.4	12.7	1.2
10	4.64	(106)	9.54	(218)	629	90	13.9	3.4	96.7	12.8	1.1
11	5.23	(208)	10.74	(427)	707	76	13.9	2.4	96.0	13.0	1.1
12	2.51	(68)	5.06	(137)	333	59	14.2	4.3	96.9	13.1	1.1
13	5.11	(108)	10.17	(215)	670	97	14.4	3.5	96.9	13.1	1.0
14	3.78	(80)	7.52	(159)	495	82	14.4	4.0	97.4	13.2	1.0
15	6.34	(134)	12.10	(256)	797	106	15.0	3.3	95.9	13.3	1.0
16	3.87	(108)	7.38	(206)	486	71	15.0	3.6	95.2	13.4	1.0
17	3.30	(92)	6.23	(174)	411	65	15.1	4.0	94.9	13.5	1.0
19	4.22	(132)	7.89	(247)	520	70	15.3	3.4	93.3	13.6	1.0
18	4.23	(161)	7.88	(300)	519	65	15.3	3.1	91.0	13.7	1.0
20	3.48	(150)	6.37	(275)	420	54	15.6	3.2	88.2	13.8	1.0
23	3.93	(133)	7.18	(243)	473	65	15.6	3.5	86.4	13.9	0.9
21	6.89	(169)	12.51	(307)	824	102	15.7	3.1	83.1	14.0	0.9
22	4.63	(196)	8.30	(351)	547	64	16.0	2.9	77.6	14.1	0.9
24	4.24	(129)	7.35	(224)	485	69	16.5	3.7	72.6	14.2	0.9
25	7.68	(182)	13.13	(311)	865	106	16.7	3.2	61.7	14.3	0.9
26	4.49	(95)	7.61	(161)	502	82	16.9	4.4	58.5	14.4	0.9
27	4.73	(124)	7.89	(207)	520	76	17.1	4.0	51.6	14.5	0.9
28	4.96	(218)	8.21	(361)	541	62	17.3	3.1	36.6	14.6	0.9
29	6.71	(159)	11.10	(263)	731	96	17.3	3.6	29.8	14.7	0.9
30	8.67	(132)	13.92	(212)	917	133	17.8	4.0	23.2	14.8	0.9
31	4.15	(144)	6.66	(231)	439	61	17.8	3.9	17.6	14.9	0.9
32	1.77	(63)	2.79	(99)	184	38	18.2	5.9	16.6	15.0	0.9
34	6.12	(145)	9.41	(223)	620	88	18.6	4.1	10.2	15.1	0.9
35	4.73	(140)	7.23	(214)	476	69	18.7	4.2	6.3	15.2	0.9
33	7.87	(193)	11.98	(294)	789	99	18.8	3.6	2.9	15.3	0.9
36	7.27	(160)	11.05	(243)	728	99	18.8	3.9	1.6	15.4	0.9
37	5.95	(146)	8.93	(219)	588	84	19.0	4.2	0.9	15.5	0.9
38	7.09	(168)	10.43	(247)	687	93	19.4	4.0	0.4	15.6	0.9
39	6.90	(140)	9.80	(199)	646	96	20.1	4.5	0.1	15.7	0.9
43	4.35	(81)	6.18	(115)	407	78	20.1	5.9	0.1	15.7	0.9
40	9.08	(192)	12.77	(270)	841	110	20.3	4.0	0.0	15.8	0.9
41	12.39	(241)	17.27	(336)	1138	135	20.5	3.6	0.0	16.0	0.9
42	7.84	(146)	10.85	(202)	715	106	20.6	4.6	0.0	16.1	0.9
44	7.32	(130)	9.96	(177)	656	103	21.0	4.9	0.0	16.2	0.9
46	9.36	(190)	12.07	(245)	795	108	22.2	4.4	0.0	16.3	0.9
45	6.42	(152)	8.27	(196)	545	82	22.2	4.9	0.0	16.4	0.9
47	3.06	(88)	3.86	(111)	254	50	22.6	6.6	0.0	16.5	0.9
48	6.88	(163)	8.61	(204)	567	84	22.8	4.9	0.0	16.6	0.9
49	15.17	(154)	17.93	(182)	1181	184	24.2	5.4	0.0	16.7	0.9
50	7.71	(176)	8.58	(196)	565	85	25.6	5.5	0.0	16.9	0.9
POOLED	5.08	(6863)	8.61	(11629)	567	29			0.0	16.9	0.9
MEAN AGE (using grain ratios)										17.1	1.3