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Provenance and Detrital-Zircon Studies of the Mint Canyon
Formation and its Correlation to the Caliente Formation, Southern California

A thesis submitted in partial satisfaction of the
requirements for the degree of Master of Science in Geology

By

Johanna Fletcher Hoyt

2012

ABSTRACT OF THE THESIS

Provenance and Detrital-Zircon Studies of the Mint Canyon Formation and its Correlation to the Caliente Formation, Southern California

By

Johanna Fletcher Hoyt

Master of Science in Geology

University of California, Los Angeles, 2012

Professor Raymond v. Ingersoll, Chair

The Middle Miocene Mint Canyon and Caliente formations represent sedimentation after triple-junction extension in southern California. Sandstone and conglomerate petrology, combined with detrital-zircon analysis, determines provenance of the Mint Canyon and Caliente formations. These data indicate that most detritus is locally derived, rather than being derived from the Chocolate Mountains across the San Andreas fault. The Mint Canyon and Caliente formations received Proterozoic anorthosite-syenite-gabbro and Triassic Lowe plutonic detritus from the San Gabriel Mountains throughout their depositional history, but show variations geographically from more locally derived sources, including Pelona Schist from Sierra Pelona.

Discriminant analysis of sandstone and conglomerate indicates strong correlation between the Mint Canyon and Caliente formations. Each group for the Mint Canyon Formation (schist (S), volcanic (V) and plutonic (P)) shows a distinct age peak (based on detrital zircons) from a nearby source rock. The plutonic group has a strong Lowe

Pluton signal (220 Ma), the volcanic group has a strong Vasquez and related volcanics signal (25 Ma) and the schist group has a strong Lowe Pluton and Pelona Schist signal (220 Ma and 75 Ma). The Caliente Formation is less distinctive, but shows the same Lowe Pluton (220 Ma), unknown local plutons (150 Ma), volcanic (25 Ma) and schist (75 Ma) signals. All samples show Proterozoic anorthosite-syenite-gabbro and gneiss signals (1200 Ma and 1700 Ma) that are weaker to the west.

This study supports the importance of integrated multi-method analyses. Conglomerate petrology, sandstone petrology and detrital-zircon analysis constrain drainage styles of Mint Canyon and Caliente provenance. Independently, each method provides limited provenance information about rock type or age, but together, they demonstrate correlation between the Mint Canyon and Caliente formations, and refine our understanding of source rocks and paleogeography.

The thesis of Johanna Fletcher Hoyt is approved.

Edward Rhodes

Axel Schmitt

Raymond V. Ingersoll, Committee Chair

University of California, Los Angeles

2012

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INTRODUCTION

Purpose

The purpose of this study is to use detrital-zircon and petrographic analyses (in conjunction with conglomerate and paleocurrent data) to determine the provenance of the Middle Miocene Mint Canyon and Caliente formations of southern California. The conclusions drawn from this study test the southern California reconstructions of Ehlert (1982, 2000, 2003) and Jacobson et al. (2011). Multiple methods used in this study, along with previous work, provide insights into the mid-Cenozoic paleogeographic and paleotectonic history of the southwestern U.S.A.

Location

The Mint Canyon Formation outcrops in Soledad basin, along the Santa Clara River in southern California in Los Angeles County (Fig. 1). The Soledad basin is located on the San Gabriel block (Jacobson et al., 2011), between the San Gabriel fault to the southwest and the San Andreas fault to the northeast.

The Caliente Formation is exposed in Ventura, Kern, San Luis Obispo and Santa Barbara counties, southwest of the San Andreas fault, and northwest of the Mint Canyon Formation (Fig. 1). Many of the outcrops are located in Lockwood Valley, Dry Canyon, Quatal Canyon and Ballinger Canyon. Most accessible outcrops of the Caliente Formation are located north of the Big Pine fault.

REGIONAL SETTING AND STRATIGRAPHY

Previous Work

Mint Canyon Formation

The Mint Canyon Formation was formally named by Kew (1923), and later described by Jahns (1939, 1940), and Oakshott (1958) as having been deposited in an eastern extension of the Ventura basin. This extension of the Ventura basin was discounted by Crowell (1975), based on his interpretation of dextral slip along the San Gabriel fault. The fluvial and lacustrine

Middle Miocene Mint Canyon Formation crops out in a westward plunging syncline in the Soledad basin (Ehlert, 1982, 2000, 2003; Fig. 1).

Early work on the Mint Canyon Formation focused on the sedimentology, stratigraphy, geochemical analysis of specific volcanic clasts, and vertebrate fauna. Ehlert (1982, 2000, 2003) focused on stratigraphic relations between the Mint Canyon Formation and surrounding rock units, paleocurrent directions, distribution and origin of conglomerate clasts, and the detailed lithology of different environments within the Mint Canyon Formation. Ehlig et al. (1975) and Ehlert (1982, 2000, 2003) proposed palinspastic reconstructions of the San Gabriel block area.

Ehlig et al. (1975, p. 83) suggested a Chocolate Mountain (Fig. 1) provenance for the Mint Canyon and Caliente formations based on clasts of the “unique rapakivi-textured quartz latite porphyry” across the San Gabriel and San Andreas faults. Joseph and Davis (1977) and Joseph et al. (1982) tested rapakivi-textured clasts from eleven locations to show a geochemical correlation; Joseph et al. (1982) concluded that $^{87}\text{Sr}/^{86}\text{Sr}$ ratios of the clasts found in the Mint Canyon Formation and those in the Chocolate Mountains correlate closely. Ehlert (1983, 2000, 2003) also used these chemical analyses from the Mint Canyon Formation, Caliente Formation and Chocolate Mountains to constrain his paleogeographic reconstruction.

The age of the Mint Canyon Formation was originally constrained to the Barstovian through Clarendonian through vertebrate fossils such as horse teeth (e.g., Stirton, 1933), as summarized by Ehlert (1982, 2003). Originally, the Tick Canyon Formation was included as basal Mint Canyon Formation, but additional vertebrate fossils signified a disconformity; Jahns (1940) redefined basal Mint Canyon Formation as Tick Canyon Formation. Tuffaceous beds in the upper Mint Canyon Formation were dated using zircon fission tracks at 10.1 and 11.6 Ma (Terres and Luyendyk, 1985). Terres and Luyendyk (1985) also suggest a net clockwise rotation of $37.1^\circ \pm 12.2^\circ$ in the San Gabriel Region since the early Miocene.

Caliente Formation

The Caliente Formation was named by T.W. Dibblee Jr. (Stock, 1947), but formally described by Hill et al. (1958), and Carman (1964). The formation was mapped and studied by Dibblee (1952), Carman (1954, 1964), Schwade (1954), Savage (1957), Hill et al. (1958), Ehlig et al. (1975), Ehlert (1982, 2000, 2003), and Prothero et al. (2008). The Caliente Formation has been poorly defined as a stratigraphic unit, and has been mapped in some areas of the Lockwood Valley region as the Quatal or Sunset Ridge formations (e.g., Carman, 1954). Carman (1964) reassigned the Quatal as Caliente Formation, using the base of the Lockwood Clay to define the upper boundary for the Caliente Formation.

Early work on the Caliente Formation focused on mapping, stratigraphy, conglomerate clast counts, paleocurrent measurements, vertebrate paleontology and magnetostratigraphy (e.g., Stock, 1947; Dibblee, 1952; Carman 1954, 1964; Schwade, 1954; Savage, 1957; Hill et al., 1958). Later work focused primarily on the clast compositions and provenance, paleocurrent directions, and tectonic offsets and rotations (e.g., Ehlig et al., 1975; Ehlert, 1982, 2000, 2003; Prothero et al., 2008).

The age of the Caliente Formation was first constrained to the Barstovian through vertebrate paleontology (Gazin, 1930). Later paleontological work in the areas of Dry and Apache canyons (Fig. 1) by Savage (1957) assigned the Caliente Formation to the Lower Pliocene. Carman (1964) assigned the Caliente Formation to the Hemingfordian through lower Claredonian through fossil evidence suggested by Savage (1957). Prothero et al. (2008) identified fossils as Hemingfordian through Hemphillian, and identified the magnetostratigraphy as representing 17.2-11 Ma.

Prothero et al. (2008) used the magnetostratigraphy and biostratigraphy to constrain age and magnitude of tectonic rotation of the Caliente Formation. The mean declinations of the polarity zones indicate that older strata (18-11 Ma) are rotated clockwise $37^{\circ} \pm 19^{\circ}$, whereas younger strata (11-9 Ma) are rotated clockwise $30^{\circ} \pm 20^{\circ}$ (Prothero et al., 2008). Rotation of the Caliente Formation coincides with capture of the Arguello microplate (Nicholson et al., 1994),

and transrotation of the Los Angeles basin (Ingersoll and Rumelhart, 1999). Prothero et al. (2008) suggested that rotation of the Caliente Formation was coincident with slip on the San Gabriel fault.

Palinspastic Reconstructions

Crowell (1960, 1962) first pointed out correlations between the eastern Orocopia Mountains and northern Chocolate Mountain region, and Soledad basin region, based on similar basement rocks. This correlation was strengthened by Silver (1971) and Ehlig and Ehler (1982) through the identification of possible Lowe Pluton clasts in the eastern Orocopia Mountains, and identification of rapakivi-textured quartz latite clasts in the Chocolate Mountains, Mint Canyon Formation, and Caliente Formation. Crowell (1975) synthesized this information to correlate the Tejon, Soledad and Orocopia regions across the San Gabriel and San Andreas faults, based on similar fault geometries, basement rocks and Tertiary strata. Ehlig et al. (1975), produced a palinspastic reconstruction of the Caliente and Mint Canyon formations that showed them as a through-going drainage originating in the Chocolate Mountains, based on the rapakivi-textured clasts found in all three areas. Joseph et al. (1982) adopted this reconstruction after finding supporting evidence from geochemical analyses. Ehler's (1982, 2000, 2003) reconstruction utilized Crowell's (1975) 240 km offset on the San Andreas fault, and 60 km of offset on the San Gabriel fault to align the Caliente and Mint Canyon formations with the Chocolate Mountains.

Jacobson et al.'s (2011) pre-Miocene reconstruction of southern California calls for sinistral slip on the Nacimiento (Fig. 11) fault to place the Nacimiento block next to Salinia, and for underplating of the Pelona-Orocopia-Rand-Catalina schists, in contrast with Saleeby's (2003) model which favors thrusting of the Nacimiento block under Salinia. Sinistral slip on the Nacimiento fault was originally proposed by Dickinson (1983), supported by conglomerate analysis by Seiders and Blome (1988) and modified by Dickinson et al. (2005). Jacobson et al.'s (2011) reconstruction incorporates the slip on the San Gabriel and San Andreas faults proposed by Crowell (1975), as well as detrital-zircon age correlation of exposed basement rocks and

sedimentary sequences. The detrital-zircon age distributions of Spafford's (2010) study of the Sespe Formation are also consistent with Jacobson et al.'s (2011) reconstruction of southern California.

During the Early Miocene, triple-junction extension resulted in development of half-graben sedimentation in coastal southern and central California, and dispersal along the coast by subsequent transform motion (Bohannon, 1975; Hendrix and Ingersoll, 1987; Tennyson, 1989, Cole and Stanley, 1995; Law et al., 2001; Ingersoll, 2008). The Simmler, Plush Ranch, Vasquez and Diligencia formations typify this period of tectonic movement (Ingersoll, 2008; Hendrix et al., 2010). In the Middle Miocene, microplate capture occurred along the southwestern continental margin, which initiated transrotation of the Western Transverse Ranges (Luyendyk and Hornafius, 1987; Luyendyk, 1991; Nicholson et al., 1994; Dickinson, 1996; Ingersoll and Rumerhart, 1999; Ingersoll, 2008). The Pelona-Orocopia schist was exposed during this transrotation (Grove et al., 2003; Jacobson et al., 2007; Ingersoll, 2008).

Stratigraphy

Mint Canyon Formation

The Mint Canyon Formation is 1230 m thick from the top of the Tick Canyon Formation (along the eastern boundary of the Mint Canyon Formation) to the base of the Castaic Formation in Bouquet Canyon (Fig. 1), but combined well-log and outcrop data suggest a thickness that exceeds 3800 m (Jahns, 1940; Ehlert, 1982, 2003). The nature of the Mint Canyon and Tick Canyon contact has been argued (e.g., Jahns 1940; Ehlert, 1982, 2000, 2003) between a conformable boundary and an unconformity, but vertebrate fauna suggest an unconformity. Paleocurrents measured from fluvial facies of the Mint Canyon Formation show westerly transport directions (Ehlig et al., 1975; Ehlert, 1982, 2000, 2003).

Ehlert (1982, 2000, 2003) described the Mint Canyon Formation in the Soledad basin as fluvial and alluvial-fan deposits of brown and greenish-gray interbedded conglomerate, sandstone, conglomeratic sandstone, siltstone and mudstone. Eastern outcrops consist of

alternating fluvial sequences of brown and green-gray conglomerate, conglomeratic sandstone and mudstone (Ehlert, 1982, 2000, 2003). Northwestern exposures composed of mostly brown, light-brown and red-brown laminated and thin-bedded mudstone and sandstone with minor amounts of conglomerate and conglomeratic sandstone are interpreted as lacustrine deposits (Ehlert 1982, 2000, 2003). Outcrops in the central area are interfingering fluvial and lacustrine facies (Ehlert, 1982, 2000, 2003).

Ehlert (1982, 2000, 2003) categorized the composition of conglomerate clasts in the Mint Canyon Formation as volcanic, metamorphic, sandstone and basement clasts, which can be organized by geographic distribution. The volcanic clasts include rhyolite to basalt including distinctive rapakivi-textured quartz-lathite porphyry. Some of the volcanic clasts were likely derived from the underlying Lower Miocene Vasquez Formation (Hendrix and Ingersoll, 1987). Volcanic clasts are abundant in the northeastern section of the Mint Canyon Formation. Metamorphic and sandstone clasts occur mostly along the northern edge of the formation and are characteristic of the Pelona Schist (e.g., Haxel and Dillon, 1978; Ehlig, 1981) and Cretaceous-Paleogene San Francisquito Formation (e.g., Kooser, 1982). Basement clasts in the Mint Canyon Formation are primarily Triassic Lowe Pluton, Proterozoic anorthosite-syenite-gabbro, Proterozoic gneiss (e.g., Silver, 1971), and Cretaceous-Paleogene Pelona Schist (Ehlert, 1982, 2000, 2003).

Caliente Formation

The fluvial and lacustrine Caliente Formation of interbedded conglomerate, arkosic sandstone, siltstone, and claystone overlies the Lower Miocene Plush Ranch Formation and Proterozoic gneissic basement in Lockwood Valley, and underlies the thin Pliocene Lockwood Clay (Gazin, 1930; Carman, 1954, 1964; Ehlert 1982, 2000, 2003; Fig 1.). To the west, the Caliente Formation lies unconformably under the Pliocene Quatal Formation (Prothero et al., 2008). The maximum thickness of the Caliente Formation increases from ~700 m in Lockwood Valley in the east to ~1700 m at the farthest western outcrop (Prothero et al., 2008).

Paleocurrents in the Caliente Formation show westerly transport directions (Ehlert, 1982, 2000, 2003).

The base of the Caliente Formation in Lockwood Valley consists of conglomerate, a lenticular lacustrine facies and an arkosic sandstone interbedded with thin orange and red-brown claystone and siltstone (Carman, 1964). Most characteristic of the lower part of the Caliente Formation are well rounded pink, red and purple volcanic clasts, and anorthosite clasts (Carman, 1964).

Some clasts in the Caliente Formation are foreign to the immediate region. Carman (1964) identified many granitic and gneissic clasts as locally derived, but the volcanic and anorthosite clasts appear to have foreign provenance. The volcanic and anorthosite clasts dominate the lower Caliente Formation, which correlates with the Mint Canyon Formation (Carman, 1964). Carman (1964) suggested an ultimate provenance of the Mojave desert for the volcanic clasts, based on the wide range of composition and Middle Miocene age, and the San Gabriel Mountains for the anorthosite clasts. Ehlert (1982, 2000, 2003) also studied clasts in the Caliente Formation in Lockwood Valley, and found them nearly identical to those in the Mint Canyon Formation.

Potential Source Terranes

San Gabriel Mountains

The San Gabriel Mountains are an east-west-trending range about 100 km long and a maximum of 38 km wide, located south of the Soledad basin (Fig. 1). The crystalline body was uplifted primarily during the late Cenozoic first by extensional faulting and later by reverse faulting (Ehlig, 1981; Hendrix and Ingersoll, 1987). The crystalline basement in the San Gabriel Mountains is separated into an upper and lower plate by the Vincent thrust fault (Ehlig, 1981). The upper plate consists of Proterozoic quartzofeldspathic gneiss (U-Pb zircon age: 1715 ± 30 Ma), and is intruded by Proterozoic gneissose granitic rocks (1670 ± 15 Ma) and a Proterozoic anorthosite-syenite-gabbro complex (1220 ± 10 Ma) (Silver, 1971; Ehlig, 1981). The Proterozoic

anorthosite-syenite-gabbro complex has been intruded by the compositionally zoned Lowe Granodiorite pluton (220 ± 10 Ma), as well as other Late Cretaceous granitic rocks (Silver, 1971; Ehlig, 1981). The lower plate is composed of Pelona Schist (Ehlig, 1981).

These Proterozoic rocks are composed of variable proportions of plagioclase, quartz, potassium feldspar, biotite, and hornblende (Ehlig, 1981; Barth and Ehlig, 1988). The metamorphic rocks of the San Gabriel Mountains are composed of augite, garnet, quartz, and alkali feldspar (Ehlig, 1981). The Lowe Pluton is characterized by a high feldspar content, and low quartz content, with little biotite (Ehlig, 1981). The Late Cretaceous granitic rocks (80 ± 10 Ma) are associated with the Lowe Pluton intrusion and vary in composition (Silver, 1971; Ehlig, 1981).

Sierra Pelona

The Pelona Schist north of the Mint Canyon and Caliente formations in both the Sierra Pelona and Mount Pinos areas, respectively, consists of metamorphosed sedimentary and volcanic rocks of transitional greenschist-blueschist grade (Burchfiel and Davis, 1981; Jacobson et al., 1988). Underplating of the Pelona-Orocopia schist occurred between 90-60 Ma (Grove et al., 2003; Jacobson et al., 2007). The Pelona Schist and the correlated Orocopia and Rand schists, are present in a northwest-southeast-trending belt extending from the southern Sierra Nevada to southwestern Arizona (Jacobson et al., 1988, 1996, 2011). The detrital-zircon age signature of the Pelona Schist is 75-100 Ma, with a smaller peak at 1700 Ma (Jacobson et al., 2011).

Chocolate and Orocopia Mountains

The Chocolate and Orocopia Mountains are located in the southern Mojave region, northeast of the Salton Sea (Fig. 1). Ehlig et al. (1975) and Ehlert (1982, 2000, 2003) first suggested the northern Chocolate Mountains and Orocopia region as the source area for the rapakivi-textured clasts in the Mint Canyon and Caliente formations. The rapakivi-textured volcanic rocks found in the Chocolate Mountains are identified by Ehlert (1982, 2000, 2003) as

light-colored quartz-monzonite porphyry, quartz-latite porphyry, and red quartz-latite porphyry. The $^{87}\text{Sr}/^{86}\text{Sr}$ ratio from Mint Canyon and Chocolate Mountain clasts is nearly identical (Joseph and Davis, 1977; Ehlert, 1982, 2000, 2003).

The Chocolate Mountains consist of a thick sequence of augen gneiss, quartzofeldspathic gneiss and schist of igneous and sedimentary protoliths (Burchfiel and Davis, 1981). The gneissic basement rock has a U-Pb zircon age of 1700 Ma (Dillon, 1976). In the Orocopia Mountains, the oldest augen gneiss yields a U-Pb zircon age of 1670 ± 15 Ma (Silver, 1971). Syenite and anorthosite in the Chocolate Mountains region have ages of 1220 Ma, similar to rocks in the San Gabriel Mountains (Silver, 1971). Volcanics in the Diligencia Formation, located in the eastern Orocopia Mountains, have been dated at 23-19 Ma (Frizzell and Weigand, 1993).

Local Sources

It is likely that some of the Mint Canyon and Caliente rocks are locally derived, either recycled from underlying strata, proximal formations, or crystalline basement.

Mint Canyon Formation

The Vasquez Formation lies below and east of the Mint Canyon Formation (Fig. 1), and has a volcanic interval near its base (Hendrix and Ingersoll, 1987). These volcanics yield K-Ar feldspar ages averaging 25-24 Ma (Crowell, 1973; Fizzell and Weigand, 1993). The Upper Cretaceous to Paleocene San Francisquito Formation (Fig. 1) is another potential proximal source for detritus in the Mint Canyon Formation in the Warm Springs Mountain area, north of the Mint Canyon Formation (Dibblee, 1967; Sage, 1973, 1975; Kooser, 1982; Prothero and Vacca, 2001).

Caliente Formation

The eastern boundary of the Caliente Formation overlies gneissic basement, which is a potential source for detritus. The Pelona Schist lies to the east and north of the Caliente Formation; north of Lockwood Valley, granite and gneiss outcrop on Mt. Pinos (Fig. 1).

Tertiary volcanics near the Caliente Formation include volcanics from the Upper Oligocene-Lower Miocene Plush Ranch Formation (Carman, 1964; Cole and Stanley, 1995) and volcanic rocks from the mid-Cenozoic Simmler Formation dated at 26.5-23 Ma and 24-22 Ma, respectively through whole rock K-Ar ages (Fig. 1; Ballance, 1983; Frizzell and Weigand, 1993). The Plush Ranch Formation consists of pebbly sandstone, lenticular conglomerate beds, and volcanic rocks (Carman, 1964); the Simmler Formation consists of alluvial-fan deposits of conglomerate and coarse sandstone (Ballance, 1983).

SANDSTONE PETROLOGY AND CONGLOMERATE COMPOSITION

Methods

Collection and Preparation

Samples were collected in Los Angeles, Ventura, Kern, Santa Barbara, and San Louis Obispo counties based on geologic maps of Dibblee (1996a, 1996b, 1996c, 2005a, 2006c, 2006e) and USGS maps (Kellogg, 2001). Locations were selected to represent the entire stratigraphic section and outcrop exposures. Lithified coarse-sand samples were collected and cut perpendicular to bedding; thin sections were prepared by Ram Alkaly from R.A. Petrographic. All thin sections were etched in hydrofluoric acid and stained with sodium hexanitrocobaltate; this etching and staining process results in easily observable differences among potassium feldspar (covered in yellow dots), plagioclase feldspar (heavily etched) and unmarked quartz (Ingersoll and Cavazza, 1991).

Petrography

Three-hundred framework grains were counted for each thin section using the Gazzi-Dickinson point-counting method (Gazzi, 1966; Dickinson, 1970; Ingersoll et al., 1984). In this method, each mineral grain coarser than silt (>0.0625 mm) is counted in a grid with spacing greater than the average grain size, and categorized according to Table 1 (point count categories). Raw point-count data are given in Appendix B; recalculated parameters are given in Table 2.

Analysis

For purposes of identifying formation correlation and provenance sources, sandstone and conglomerate data were discriminantly analyzed. Sandstone and conglomerate (see below) data were formatted for log-transformations by arbitrarily replacing any zeros with 0.5 to avoid division by zero (Tables 3 and 4); the counted variables were transformed into log-ratio variables (e.g., Weltje, 2002). The log-ratio transformed data were then used for statistical analysis since constant-sum constraints of percentages are eliminated, resulting in values that vary independently (Koch and Link, 1971). The data were log-ratio transformed using the equation: $y_i = \log(x_i/x_k)$, where x_i represents the abundance of any i^{th} component and x_k represents the abundance of the k^{th} component, selected to be the common denominator (Koch and Link, 1971). Qm was selected as the k^{th} component because of its ubiquitous presence. These methods follow those of Ingersoll and Eastmond (2007).

Modal data were analyzed using discriminant analysis with the program *Systat 10* (SPSS, 2000) under backward stepwise conditions (e.g., Ingersoll and Eastmond, 2007). Discriminant analysis calculates the plane in multi-dimensional space that best separates previously defined groups. Groups (petrofacies) are iteratively defined according to the group parameters that produce the highest 'percent correct' in the classical and jackknifed matrices. The 'percent correct' refers to the percent of samples assigned by the program to the same groups assigned by the user. In conjunction with the classical and jackknifed matrices produced by *Systat 10*, canonical plots are also generated as a visual means of displaying the differences among defined groups. The axis that defines the plane that best separates the defined groups is a linear combination of the individual variables calculated as most important for group separation.

Results

Discriminant Analysis

Conglomerate

Conglomerate clast data from Ehler (2000) were compiled and categorized into six preliminary petrofacies groups according to the dominant clast groups in Ehler's (2000) map of conglomerate clast counts in the Mint Canyon Formation. Conglomerate compositions were transformed into log-ratio values and subjected to discriminant analysis using the same methods as for sandstone data (e.g. Weltje, 2002; Ingersoll and Eastmond, 2007) (see above) (Table 4; Appendix A). Four of Ehler's (2000) samples were removed from the data set due to location outside of the Mint Canyon Formation. Discriminant analysis was performed on the Mint Canyon samples of Ehler's (2000) six groups. Individual samples were moved to neighboring groups during four iterations of discriminant analysis in order to improve grouping. Based on significant overlap in compositions, Ehler's sandstone and other groups were combined; his anorthosite and syenite groups were combined during additional iterations. This iterative process resulted in the conglomerate data being categorized into four distinct petrofacies groups, with only four outliers out of 114 samples. Thus, 96% of samples were "correctly" categorized.

The adjusted naming scheme for the resultant groups are plutonic (P), schist (S), volcanic (V) and other (O). Ehler's (2000) groups anorthosite and syenite were combined into the plutonic group. The Pelona Schist group became the schist group, and the volcanic group was not renamed. Criteria for classification of conglomerate samples in each group also underwent minor adjustments. Conglomerate samples with >10% anorthosite clasts were assigned to the plutonic group; samples with $\geq 78\%$ volcanic clasts were assigned to the volcanic group; and samples with >20% Pelona Schist clasts were assigned to the schist group. If a conglomerate sample did not belong to any of these groups, it was classified as other.

Once correct classification was maximized for Mint Canyon conglomerate samples, nine Caliente conglomerate samples were added as a new group "C". The discriminant-analysis program then identified "misclassified" samples, which were then reassigned to the "predicted group" suggestion. All Caliente conglomerate samples were thus reassigned to the most

probable Mint Canyon groups to increase the “correctness” of the groups. Using all 123 samples, five misclassified outliers remained within the combined Mint Canyon-Caliente conglomerate groups, after the maximum “correctness” was achieved through six iterative runs (Appendix A; Table 5), resulting in 96% “correct” classification.

The classical classification matrix used by the discriminant-analysis program assigns each sample to the group where the value of its classification function is highest (Koch and Link, 1971). The results from this classification matrix may be misleading and overoptimistic because the evaluated sample is included with the same samples used to compute it (Koch and Link, 1971). The jackknifed matrix attempts to correct this potential problem using all of the data except the sample being classified (Koch and Link, 1971). If the difference between the “correctness” calculated by the classical classification and jackknifed matrices is not great, then it is safe to assume that the classification matrix does not yield a misleading result (Koch and Link, 1971).

The final “correctness” of the classical classification matrix is 96%, and the “correctness” of the jackknifed matrix is 95% (Table 5). The importance of variables used to calculate the maximum differences among the groups by order of decreasing importance is schist (LOGPSO F-to-remove = 203.15), volcanic (LOGTVO F-to-remove = 66.98), plutonic (LOGANSYO F-to-remove = 63.88), and other (LOGLO F-to-remove = 10.65) (Table 5). The canonical scores plot produced by the final iteration show distinct regions for each petrofacies group (Fig. 2) The slight overlap in the 65% confidence limits of the data are due to the “misclassification” of four samples. The canonical scores of group means show that factor(1) is dominated by Pelona Schist (higher negative values), whereas factor(2) is dominated by the volcanic clasts (higher positive values) (Table 5).

All Caliente conglomerate samples fit into the Mint Canyon groups. It can be concluded that conglomerate from both the Mint Canyon Formation and the Caliente Formation were

derived from similar source rocks and likely came from the same drainage, as concluded by Ehlert (1982, 2000, 2003).

Conglomerate data of the Caliente Formation from Carman (1954) were not used because of incompatible counting criteria.

Sandstone

Sandstone point-count data were recalculated into log-ratios with 15 independent variables (e.g., Weltje, 2002; Ingersoll and Eastmond, 2007) (Table 3). The sandstone samples were grouped according to the conglomerate groups established by geographic location according to the Ehlert map of clast-type distributions, first for the Mint Canyon samples. The resultant fit with the four established groups was not ideal, and the percent “correct” according to the jackknifed matrix was 67%. The program was run with the Mint Canyon samples and three Caliente samples that could be grouped according to the four conglomerate groups. The other group was included at this stage, but the plutonic and other group were not distinguishable and the percent “correct” according to the jackknifed matrix decreased (33%). The program was then run with the Mint Canyon samples and three Caliente samples in three groups. The other group was dissolved and measurable differences between groups increased, but the percent “correct”, according to the jackknifed matrix, decreased further (13%). All of the Caliente samples were reassigned to group “C”. This resulted in the Caliente and plutonic groups becoming almost indistinguishable, but the percent “correct”, according to the jackknifed matrix, improved. The Mint Canyon and all Caliente samples were then assigned to three established groups: plutonic, volcanic and schist. The Caliente samples were assigned to the plutonic group. Mint Canyon samples originally categorized as other were also recategorized as plutonic. This resulted in the best percent “correct” according to the jackknifed matrix (82%) and classical classification matrix (100%) (Table 3).

The three most important variables in discriminating among the four groups are monocrystalline plagioclase (LOGFPQM F-to-remove = 16.54), microlitic lithic volcanic

(LOGLVMQM F-to-remove = 11.07), and aggregate metamorphic lithic (LOGLMAQM F-to-remove=8.21) (Table 5). The Canonical scores plot for the sandstone data from this final iteration show three distinct groups (Fig. 3). The canonical scores of group means show factor(1) is dominated by Pelona Schist (higher negative values), whereas factor (2) is dominated by volcanic clasts (higher positive values) (Table 5).

Petrology

Sandstone

Mint Canyon and Caliente samples grouped by discriminant analysis were plotted on QFL, LmLvLs and QmFkFp ternary diagrams (Fig. 4). The samples are dominantly quartzofeldspathic, with plagioclase dominating potassium feldspar (Fig. 4). Aphanitic lithic fragments are diverse. Microlitic grains are the most common volcanic type in the Mint Canyon Formation; granular and seriate grains are most common in Caliente volcanic types.

The samples also contain abundant monocrystalline biotite. The overall composition suggests that intermediate plutonic rocks dominated the ultimate source rocks.

Conglomerate

Mint Canyon and Caliente conglomerate compositions were plotted on O[L+An+Sy][Tv+Ps], PsTvO and OL[Tv+An+Sy] ternary diagrams, organized by petrofacies group and formation (Fig. 5). The conglomerate variables (other (O), Lowe Granodiorite (L), anorthosite (A), syenite (S), Tertiary volcanic (Tv) and Pelona Schist (Ps)) were combined to make triangular plots analogous to the sandstone QFL, LmLvLs, QmFkFp plots. The variable O contains quartz-rich sandstone clasts (Q). L+An+Sy are dominantly feldspathic (F). Tv+Ps were used as an analogue for aphanitic lithic grains (L). Ps, Tv and O were used as analogs for Lm, Lv, and Ls. The OL[Tv+An+Sy] ternary is analogous to the QmFkFp ternary; where O represents Qm, L represents Fk and Tv+An+Sy were combined to represent Fp.

The O[L+An+Sy][Tv+Ps] ternary indicates that most samples have abundant volcanic and schist clasts, with the exception of the plutonic group, which plots nearest the L+An+Sy

apex. The Caliente Formation, regardless of petrofacies, plots on all the ternaries near plagioclase-rich or volcanic apices. The PsTvO ternary best distinguishes the schist group from the other groups.

The conglomerate and sandstone ternary diagrams show some similarities. The QmFkFp diagram shows a similar distribution of sample compositions to the QL[Tv+An+Sy] ternary. The compositions are mainly quartz-plagioclase-rich. The LmLvLs and PsTvO ternaries both show diverse compositions, and the QFL and O[L+An+Sy][Tv+Ps] ternaries show the Mint Canyon plutonic group plotting as quartzofeldspathic. The sandstone and conglomerate ternary diagrams illustrate that the samples are dominantly of plutonic and volcanic origin.

Discussion

The canonical scores plots (Figs. 2 and 3) of the sandstone and conglomerate data of the Mint Canyon and Caliente samples are similar in distribution and shape, especially for the plutonic, schist and volcanic groups. Factor(1) is dominated by schist and factor(2) is dominated by volcanic composition on both plots (Table 5). Some of the differences between the plots include samples in the volcanic group with greater spread on the sandstone plot. This may be explained by the smaller number of samples available to define the average value of the group.

The major difference between the canonical plots for the sandstone and conglomerate samples is the absence of the other group on the sandstone plot. The conglomerate other group includes abundant sandstone and miscellaneous clast types. These sandstone conglomerates mostly were derived from the quartzofeldspathic Cretaceous-Paleogene San Francisquito Formation (Ehlert, 1982, 2000, 2003). These sandstone clasts disaggregate into plutoniclastic (arkosic) sand, that was reconstituted into the sandstone plutonic group.

These results demonstrate the similarities between Mint Canyon and Caliente composition in both sandstone and conglomerate samples. These results make a compelling argument for similar source rocks, and a likely contiguous drainage system, as proposed by Ehlig et al. (1975) and Ehlert (1982, 2000, 2003).

DETRITAL-ZIRCON ANALYSIS

Methods

Collection and Preparation

Samples for detrital-zircon analysis were collected from the same locations as the sandstone samples (Fig. 1; Appendix C). Poorly lithified sand and sandstone were preferred for sampling; sand was scraped off the outcrop into a bag where poorly lithified. In cases of sandstone cemented by carbonate, rock pieces were collected for later disaggregation in an HCl bath. Samples were then crushed by a rock crusher and grinder, and sieved for a size fraction <250 μm to safely capture all zircons but exclude rock fragments. The resultant grains were run over a water table at Pomona College for the initial separation of dense minerals. A strong hand magnet was passed through each dense-mineral separate until only weakly magnetic dense minerals were left. Then the Frantz Iso dynamic® magnetic separator was used for further removal of magnetic material. Methylene Iodide was used as a dense liquid in the final step in separation. The remaining fraction of sand was ~90% zircon. These samples were sent to the Arizona LaserChron Center at the University of Arizona, and mounted on an epoxy plug for analysis. Each mount contained one sample and a strip of zircon crystals from a well calibrated standard.

Analysis

All but two of the detrital-zircon samples were analyzed at the Arizona LaserChron Center using the Laser-Ablation Multicollector ICP Mass Spectrometer. The two samples not analyzed were compromised due to detrital-zircon cross contamination during dense-liquid separation. The Laser Ablation Mass Spectrometer uses a laser beam to ablate a 12 μm pit in the exposed interior of the grains of each individual zircon grain (Gehrels et al., 2008). The ablated material is ionized in a plasma, and accelerated through the spectrometer with ^{206}Pb , ^{207}Pb , ^{208}Pb , ^{232}Th and ^{238}U which are measured with 1×10^{11} ohm resistors in Faraday collectors, and ^{204}Pb is measured with a channeltron multiplier (Gehrels et al., 2008). Between

35 and 85 zircons were analyzed for each sample (Appendix C). For every 10 unknown zircon crystals analyzed, five Sri Lanka zircon standards were also analyzed to correct for measurement drift during sample analysis due to the fractionation of U, Th and Pb during laser ablation (Gehrels et al., 2008). Uncertainties occur through measurement and systematic errors. The systematic errors include uncertainties in decay constants for ^{238}U and ^{235}U , uncertainty of the age of the standard used for fractionation correction, average uncertainty of the fractionation correction, and average uncertainty from the composition of common Pb (Gehrels et al, 2008). Measurement errors are only applicable to single analyses; $^{206}\text{Pb}/^{238}\text{U}$ and $^{206}\text{Pb}/^{204}\text{Pb}$ for $^{206}\text{Pb}/^{238}\text{Pb}$ ages, $^{206}\text{Pb}/^{207}\text{Pb}$ and $^{206}\text{Pb}/^{204}\text{Pb}$ for $^{206}\text{Pb}/^{207}\text{Pb}$ ages, and all mentioned for $^{207}\text{Pb}/^{235}\text{U}$ ages. The accuracy of age measurements is 1-2% (Gehrels et al., 2008).

Results

The detrital-zircon data were plotted as individual probability density plots, and grouped by sandstone petrofacies, as well as stratigraphically within each group (Figs. 6, 7, 8 and 9). The age distributions and change of dominant ages by geographic location suggest local derivation for most zircons.

The age peaks are dominantly Mesozoic for the Mint Canyon and Caliente formations, with distinct peaks at 24 Ma, 75 Ma, 150 Ma, 225 Ma, and 1200 Ma, and low, broad peaks at 1400 Ma, and 1700 Ma (Figs. 6, 7, 8 and 9). There is a noticeable absence of ages between 275 Ma and 1100 Ma (excluding single measurements at 450 Ma and 550 Ma). The age distributions for samples JFH-11-14M, JFH-11-15C and JFH-11-16C show similar age peaks and are also geographically close together after unslipping the San Gabriel, Big Pine, and San Andreas faults (Fig. 10). JFH-11-14M is part of the uppermost Mint Canyon Formation, and JFH-11-15C and JFH-11-16C are stratigraphically near the lower Caliente Formation (Fig. 1). These similarities support correlation of the Mint Canyon Formation with the lower half of the Caliente Formation (Ehlert, 2003), but there are no similarities beyond these three probability

density plots. For better resolution, more of the Caliente would need to be sampled and detrital zircons dated.

Detrital zircons of the Mint Canyon Formation appear to be primarily locally derived. The 25 Ma peak dominates the volcanic group. The schist group is dominated by a peak at 220 Ma (samples JFH-11-1M, JFH-11-4M, JFH-11-8M), and a peak at 75 Ma (samples JFH-11-10M, JFH-11-14M) (Fig. 7). The plutonic group is dominated by a peak at 220 Ma (samples (JFH-11-3M, JFH-11-12M, JFH-11-13M) (Fig. 6).

Ages of the Caliente Formation detrital-zircon samples are more varied than those of the Mint Canyon samples (Fig. 9), but quantitatively age peaks overlap. The dominant age peaks for the Caliente samples are 25 Ma, 75 Ma, 150 Ma, 220 Ma, and 250 Ma. Most samples have minor peaks at 1200 Ma and 1700 Ma that diminish towards the westernmost sampling locations. The wide variations and similarities of ages also suggest local derivation similar to the Mint Canyon Formation.

PALEOGEOGRAPHIC IMPLICATIONS

Paleocurrent data, conglomerate and sandstone petrology, and detrital-zircon data from the Mint Canyon and Caliente formations can be used to determine Mint Canyon and Caliente correlation and provenance. The combination of source-rock ages based on detrital zircons with source-rock compositions based on conglomerate and sandstone petrology provides a robust mechanism for determining provenance.

Mint Canyon and Caliente Provenance

The detrital-zircon, sandstone and conglomerate data are consistent with primarily local derivation from the San Gabriel Mountains and Sierra Pelona, as well as volcanic rocks in the Chocolate Mountains and the Vasquez Formation. The age peaks can be explained by sources nearby, although the Mint Canyon Formation appears to have received more contribution from the San Gabriel Mountains than the Caliente Formation, based on the intensity of 220 Ma, 1200 Ma and 1700 Ma peaks in Mint Canyon samples (Figs. 6 and 9).

These results suggest a provenance for the Mint Canyon Formation that is varied geographically. The three groups are located near local outcrops of Pelona Schist, Vasquez volcanics, and Lowe and anorthosite-syenite-gabbro plutons, respectively (Fig. 1). Proximity to these outcrops is observed in the dominant age signatures of the detrital zircons. The plutonic group is dominated by the 220 Ma Lowe Pluton with subordinate 1200 Ma anorthosite-syenite-gabbro peaks (Silver, 1971; Ehlig, 1981). The schist group is dominated by the 220 Ma Lowe Pluton (Silver, 1971, Ehlig, 1981), and the 75 Ma Pelona Schist (e.g., Jacobson et al., 2011). There are also subordinate 25 Ma peaks that may be attributed to Vasquez volcanics (Crowell, 1973; Hendrix and Ingersoll, 1987). This is unsurprising since the location of the schist group samples is immediately west of the volcanic group. The volcanic group, which is dominated by 25 Ma zircons is located next to the Vasquez volcanics outcrop (Fig. 1); some of the 25 Ma zircons probably were derived from the Chocolate Mountains (e.g., Ehlert, 1982, 2000, 2003). Most Mint Canyon samples have 1200 Ma and 1700 Ma peaks indicative of the anorthosite-syenite-gabbro complex and older gneisses in the San Gabriel Mountains (e.g., Ehlert, 1981). The sandstone and conglomerate are consistent with the Lowe Pluton peak from the plutonic group, as well as the Vasquez volcanics and Pelona Schist peaks in the volcanic and schist groups.

Several Caliente samples show a dominant 75 Ma peak, which may be attributed to a greater abundance of detritus received from the Pelona Schist (Fig. 9). In contrast to the Mint Canyon Formation, the Caliente is characterized by a few age peaks, mainly of Lowe Pluton age. A few 25 Ma peaks may represent derivation from a neighboring formation such as the Plush Ranch or Simmler formations (e.g., Carman, 1964; Ballance, 1983; Frizzell and Weigand, 1993; Cole and Stanley, 1995) or be derived from the Vasquez volcanics or Chocolate Mountains (e.g., Ehlert, 1982, 2000, 20003; Hendrix and Ingersoll, 1987; Hendrix et al., 2010). There is an unidentified source rock of 150 Ma, which also may have been a proximal source. In Jacobson et al.'s (2011) reconstruction, plutons in the vicinity of the Caliente Formation between

the San Gabriel and San Andreas faults of the correct age may have been sources (Fig. 11). The 1200 Ma and 1700 Ma peaks, indicative of the anorthosite-syenite-gabbro complex in the San Gabriel Mountains, are weaker farther west, which is controlled by distance from the source rocks. This suggests a provenance of dominantly plutonic and volcanic rock for the Caliente Formation, most likely from the San Gabriel Mountains, as first suggested by Carman (1964), along with local sources. Differences between the Mint Canyon Formation and the upper Caliente Formation could correspond to movement on the San Gabriel fault following deposition of the Mint Canyon Formation.

Ehlig and Ehlert (1975), Ehlert (1982, 2000, 2003) argued for derivation primarily from the Chocolate Mountains (Fig. 1), based on the rapakivi-textured rocks found in the Chocolate Mountains, as well as the Mint Canyon and Caliente formations. Some of the detritus undoubtedly is far traveled, but the great variation in ages geographically within the Mint Canyon and Caliente formations suggests heterogeneous and locally derived detritus (e.g., Ingersoll et al., 1993).

PALINSPASTIC RECONSTRUCTION

Using cross-fault correlations of Bohannon (1975), Crowell, (1975), Tennyson (1989), Hendrix et al. (2010) and references therein, and the Mint Canyon and Caliente formations, as well as fault-slip timing and rates, rotations, and possible source areas east of the San Andreas fault, a palinspastic reconstruction was generated for 18 Ma (Fig. 10), just prior to deposition of the Mint Canyon Formation.

For purposes of simplification, the rock types shown on the palinspastic reconstruction have been grouped into five categories (Fig. 10). Middle Miocene nonmarine strata include the Mint Canyon and Caliente formations (Carman, 1964; Ehlig and Ehlert, 1975; Ehlert, 1982, 2000, 2003). Uppermost Oligocene-Lower Miocene nonmarine strata include the Plush Ranch, Simmler, Vasquez, Diligencia and Tick Canyon formations (Birman, 1950; Ballance, 1983; Hendrix and Ingersoll, 1987; Cole and Stanley, 1995; Law et al., 2001). Cretaceous-Paleogene

marine strata include the San Francisquito and Maniobra formations (Sage, 1973, 1975; Kooser, 1982; Advocate et al., 1988) and related unnamed strata. The upper plate (above the Vincent-Orocopia thrust) includes Proterozoic-Mesozoic crystalline basement, and the lower plate includes the Orocopia-Pelona Schist (Jacobson et al, 1988, 1996, 2007, 2011).

Reversal of clockwise rotation of the Orocopia, Soledad and Tejon blocks were completed according to Luyendyk and Hornafius (1987) and Luyendyk (1991). The Caliente Formation was unrotated counterclockwise 30° within the error margin calculated by Prothero (2008). The San Gabriel block was unrotated 45° (Terres and Luyendyk, 1985; Luyendyk and Hornafius, 1987; Luyendyk, 1991). The Diligencia Formation was unrotated 90° (Terres and Luyendyk, 1985). Reversal of rotation of the blocks and unslipping the Canton-Verdugo (30 km), San Gabriel (40 km), and San Andreas (240 km) faults result in open areas in the palinspastic reconstruction (Fig. 10). The uncertain relations in these areas could be explained by subsequent significant shortening that has not been incorporated into this reconstruction.

Movements on the Big Pine (5-0 Ma), Canton-Verdugo (18-12 Ma), San Gabriel-Vasquez Creek (12-5 Ma), and San Andreas-Punchbowl faults (18-0 Ma) were reversed to 18 Ma, just prior to sedimentation of the Mint Canyon and Caliente formations. Timing and slip of the San Gabriel, San Andreas and Canton-Verdugo faults were taken from Graham et al. (1989) and Crowell (1975, 2003). The Big Pine fault was unslipped to undo offset within the Caliente Formation, and to align the Pine Mountain and Nacimiento faults. The Ozena and San Guillermo faults were also aligned, while Big Pine fault slip was reversed. The Vasquez Canyon fault was correlated to the Big Pine fault, aligning the Vasquez Formation of Texas Canyon with its offset equivalent, the Plush Ranch Formation (Bohannon, 1975; Crowell, 1975, 2003; Tennyson, 1989, Ingersoll, 1999, 2008; Hendrix et al., 2010; Jacobson et al., 2011). The San Francisquito fault and Orocopia Mountains detachment fault, and the Pelona and Orocopia schists were also aligned, resulting in a clearly linear trend of schist antiforms (Jacobson et al., 1988, 1996, 2011). The Diligencia fault was connected with the Clearwater fault to align Cretaceous-Paleogene

marine strata, which include the San Francisquito and Maniobra formations (Dibblee, 1967; Sage 1973, 1975; Advocate et al., 1988).

CONCLUSIONS

Results from this study refine Early Miocene paleogeographic and tectonic reconstructions of southern California. The Mint Canyon and Caliente formations, which were deposited in the Early Miocene, were mostly locally derived from surrounding areas through local drainages that transported detritus northward from the San Gabriel Mountains and southward from Sierra Pelona. A larger central drainage supplied sediment from the Chocolate Mountains to both the Mint Canyon and Caliente formations. Detrital-zircon ages suggest that the Proterozoic anorthosite-syenite-gabbro complex in the San Gabriel Mountains and the Triassic Lowe Pluton provided detritus directly to the Mint Canyon Formation for most of its depositional history, with diminished contributions to the Caliente Formation farther west.

This study highlights the importance of provenance analysis using multiple techniques for more robust conclusions. Conglomerate and sandstone analyses show a likely correlation between the Mint Canyon and Caliente formations and are useful for identifying potential source rocks. Conglomerate contains specific source rocks, whereas sandstone reveals a general quartzofeldspathic composition. This relatively homogenous sandstone composition is likely due to the plutonic nature of the majority of primary source rocks and the tendency of these rocks to disaggregate into quartz and feldspar. The detrital-zircon age distributions indicate primarily local derivation from the San Gabriel Mountains, Sierra Pelona, and local sources, as well as derivation from the Chocolate Mountains area. Correlation of the Mint Canyon and Caliente formations is not clearly demonstrated by detrital-zircon age distributions, but similar age peaks occur in the uppermost Mint Canyon and lower Caliente samples, suggesting age correlation. Although some detritus in the Mint Canyon and Caliente formations was derived from the Chocolate Mountains, most was locally derived. The upper Mint Canyon and lower Caliente

formations are likely correlated and were mostly fed by small drainages from nearby sources with a larger drainage with headwaters in the Chocolate Mountains.

FIGURES

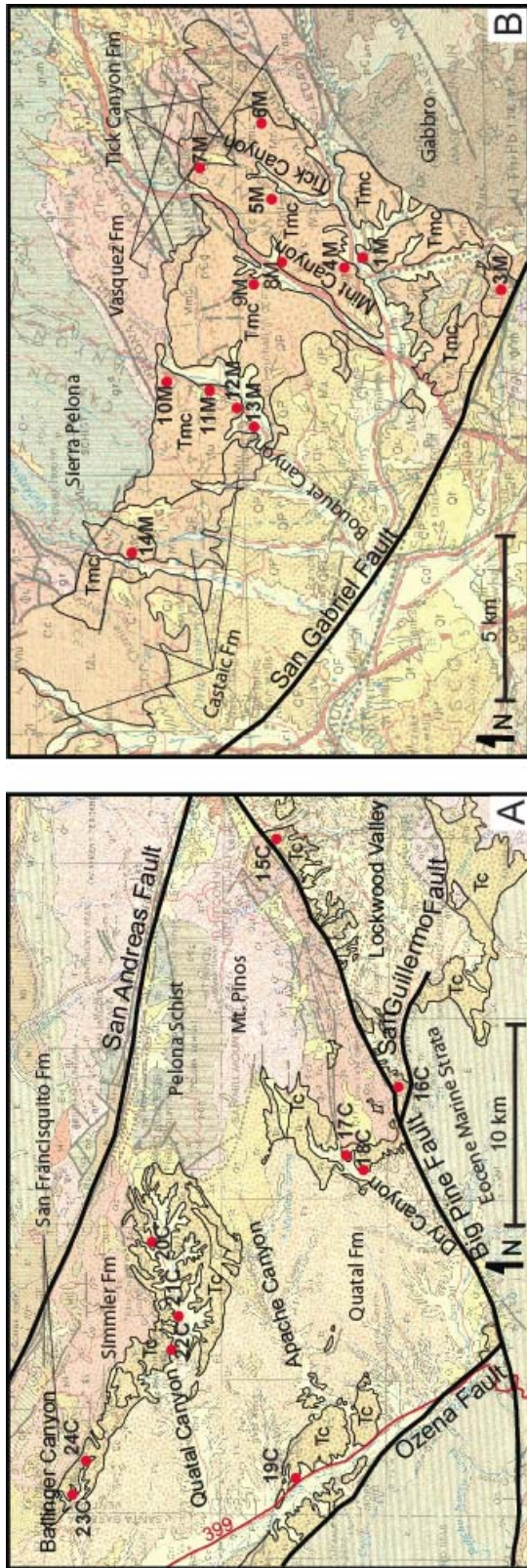
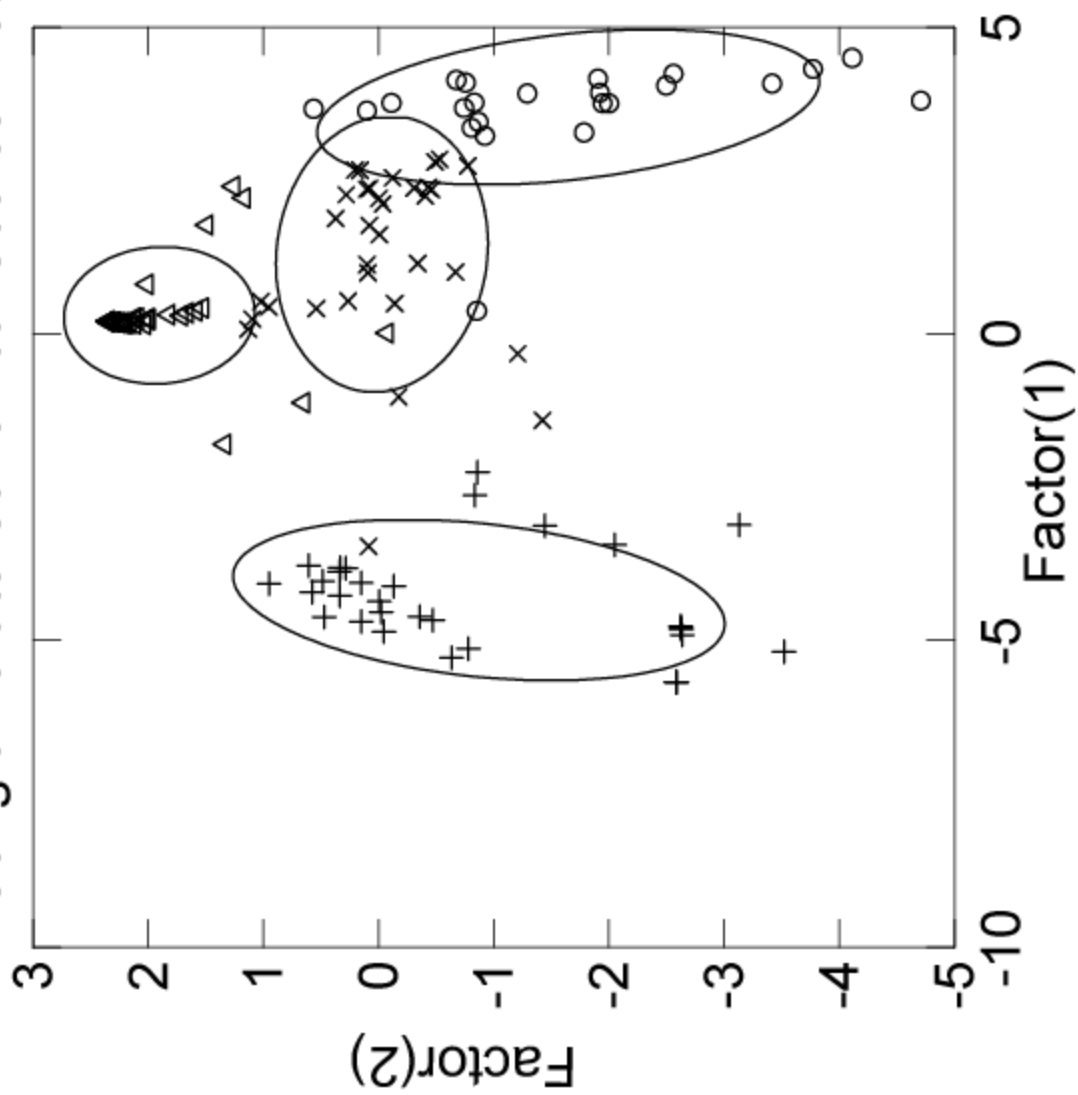


Figure 1: Location map of sample sites: (A) Calliente Formation (Tc) southwest of the San Andreas fault. (B) Mint Canyon Formation (Tmc) in Soledad basin along the Santa Clara River northeast of the San Gabriel fault. (C) Regional map of southern California showing locations of study areas and major faults.

Conglomerate Canonical Scores Plot

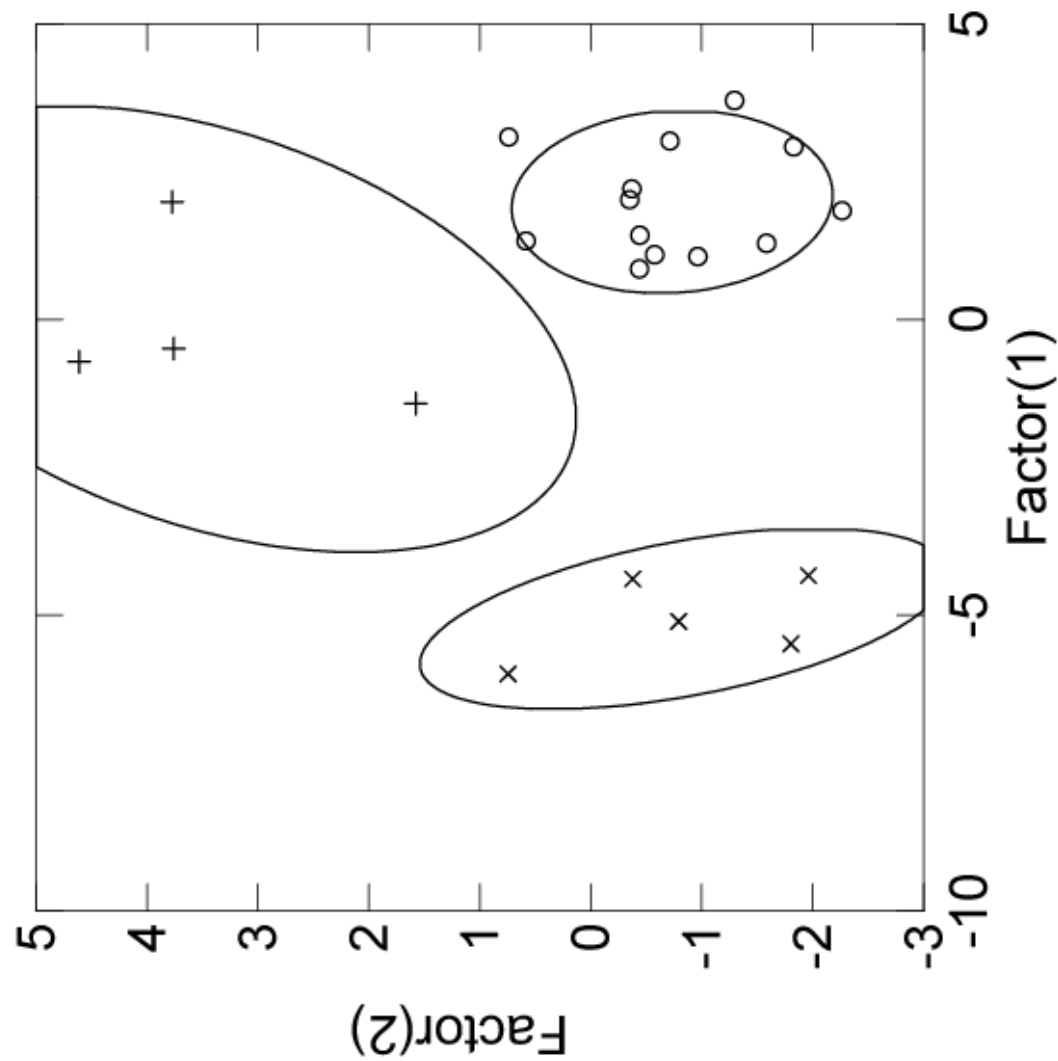


PETROFACIES

○ P
 × O
 + S
 △ V

Figure 2: Conglomerate canonical scores plot showing petrofacies groups: P (Plutonic), O (Other), S (Schist), and V (Volcanic). 65% confidence limits of the data are shown as ellipses for each petrofacies group. All Mint Canyon and Caliente samples are plotted.

Sandstone Canonical Scores Plot



PETROFACIES

- P
- ×
- +

Figure 3: Sandstone canonical scores plot showing petrofacies groups: P (Plutonic), S (Schist), and V (Volcanic). 65% confidence limits of the data are shown as ellipses for each petrofacies group. All Mint Canyon and Callente samples are plotted.

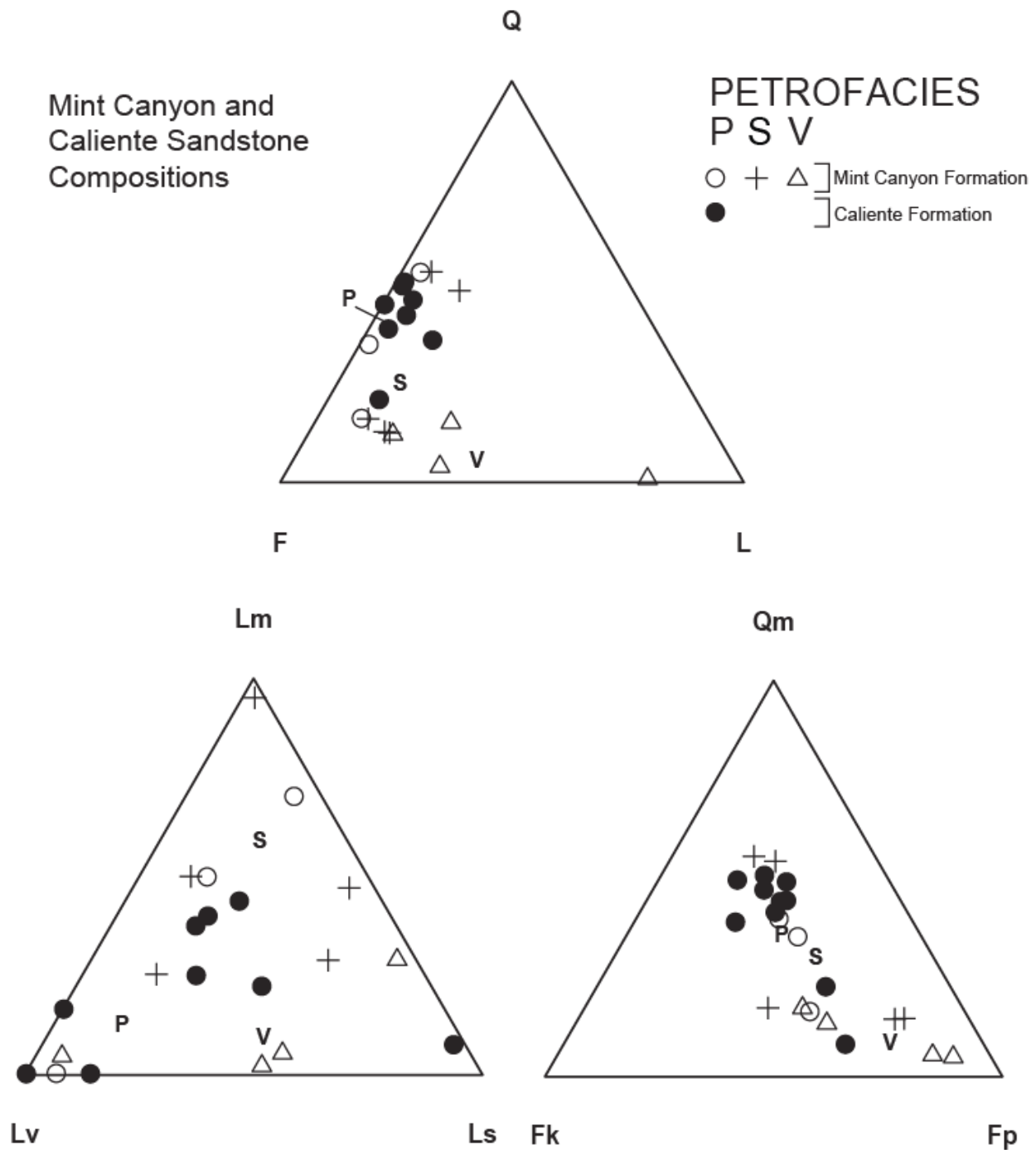


Figure 4: QFL, LmLvLs, and QmFkFp plots (see Table 1) of Mint Canyon and Caliente sandstone samples. Petrofacies group geometric means are represented by P (plutonic), S (schist) and V (volcanic). Each sandstone sample is represented by a circle (Caliente Formation), square, cross or triangle (Mint Canyon Formation).

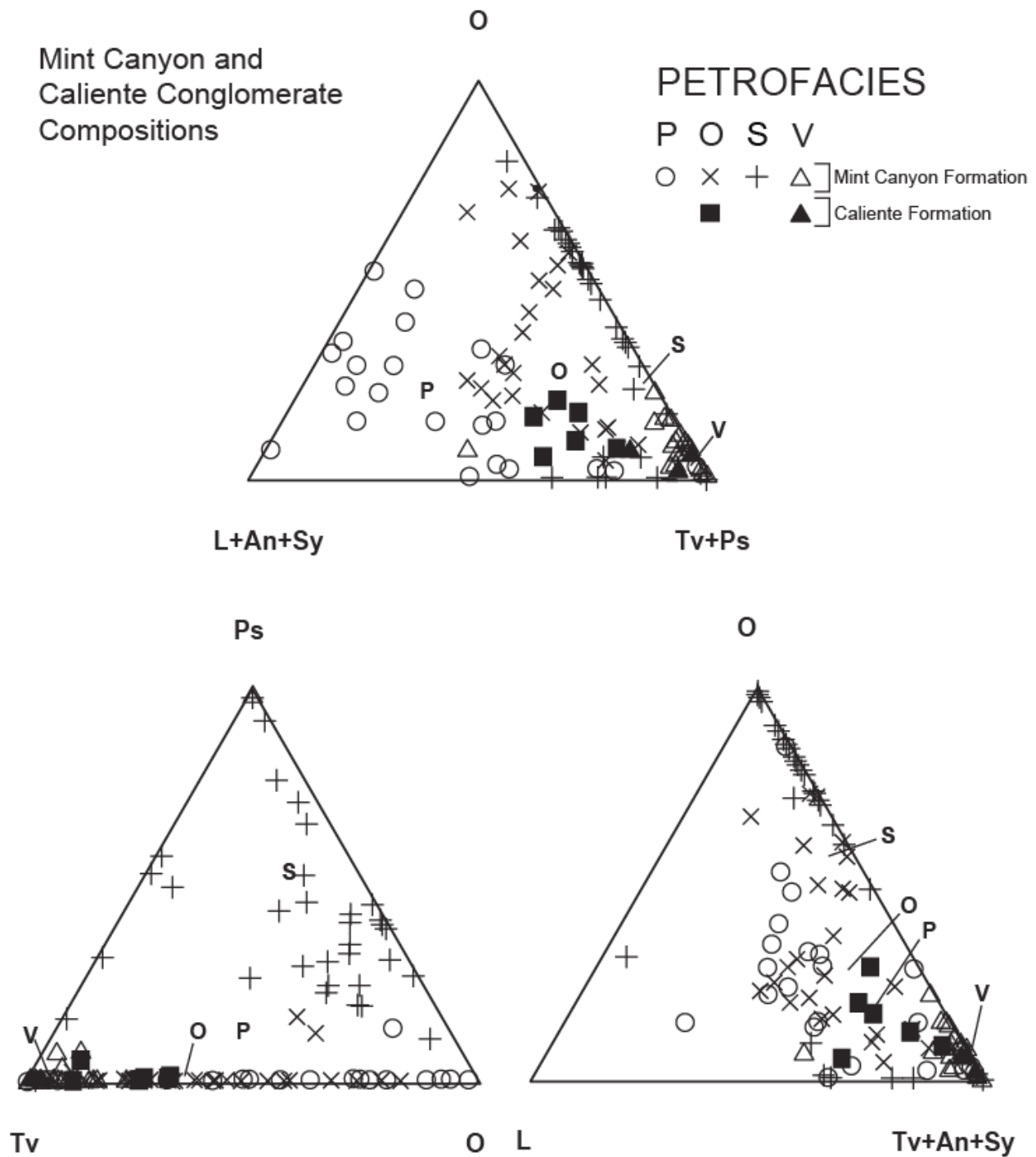


Figure 5: $O[L+An+Sy][Tv+Ps]$, $PsTvO$, and $OL[Tv+An+Sy]$ plots of conglomerate counts (Ehlert, 2000). The variables Other (O), Lowe Granodiorite (L), Anorthosite (An), Syenite (Sy), Tertiary volcanics (Tv), and Pelona Schist (Ps) were combined to make triangular plots analogous to the sandstone QFL, LmLvLs, and QmFkFp plots (see text). The solid black triangles and squares represent conglomerate compositions for the Caliente Formation; other symbols represent the Mint Canyon Formation conglomerate compositions. Petrofacies group geometric mean represented by P (plutonic), O (Other), S (schist) and V (volcanic).

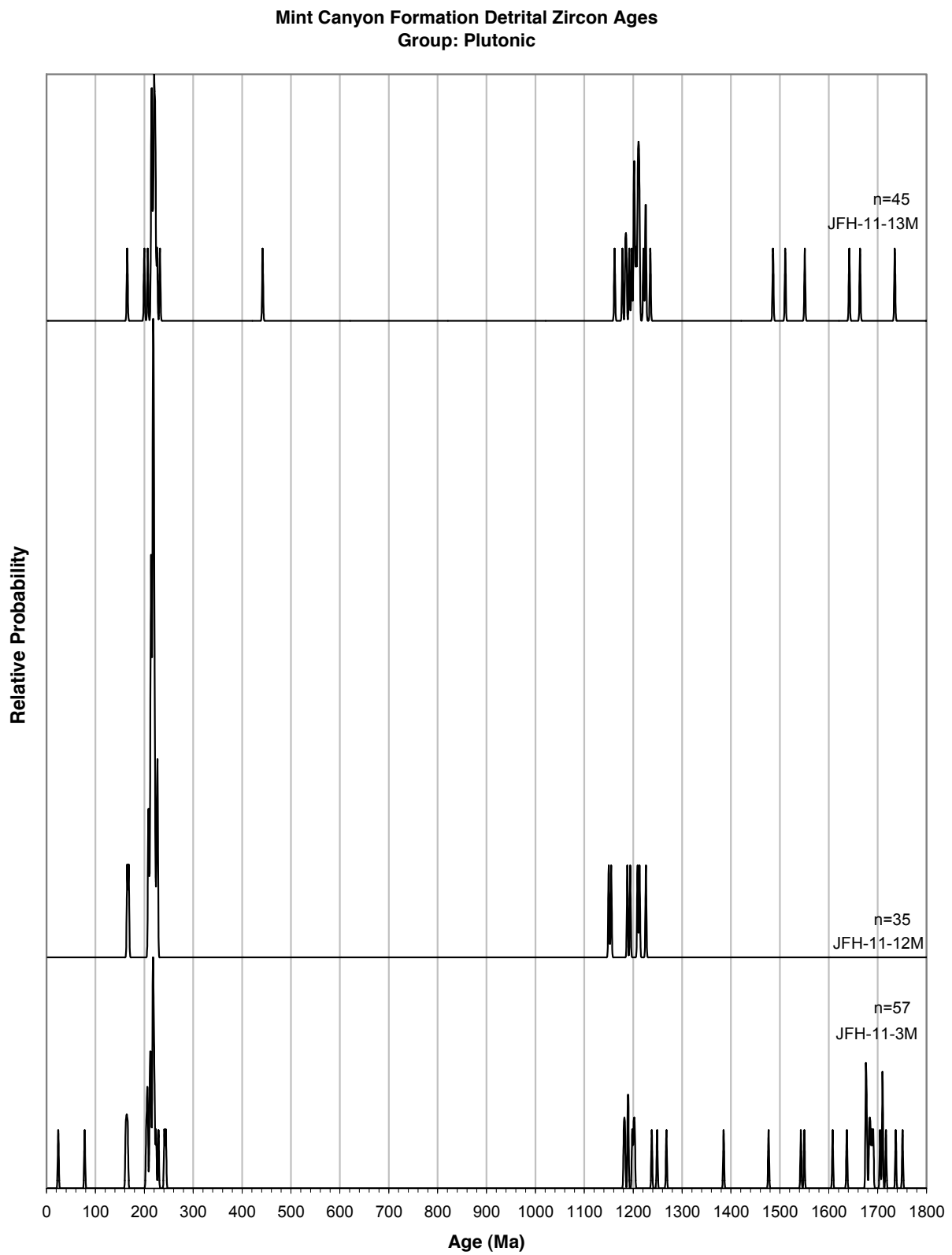


Figure 6: Probability age-distribution of Mint Canyon detrital zircons in the plutonic group.

Mint Canyon Formation Detrital Zircon Ages
Group: Schist

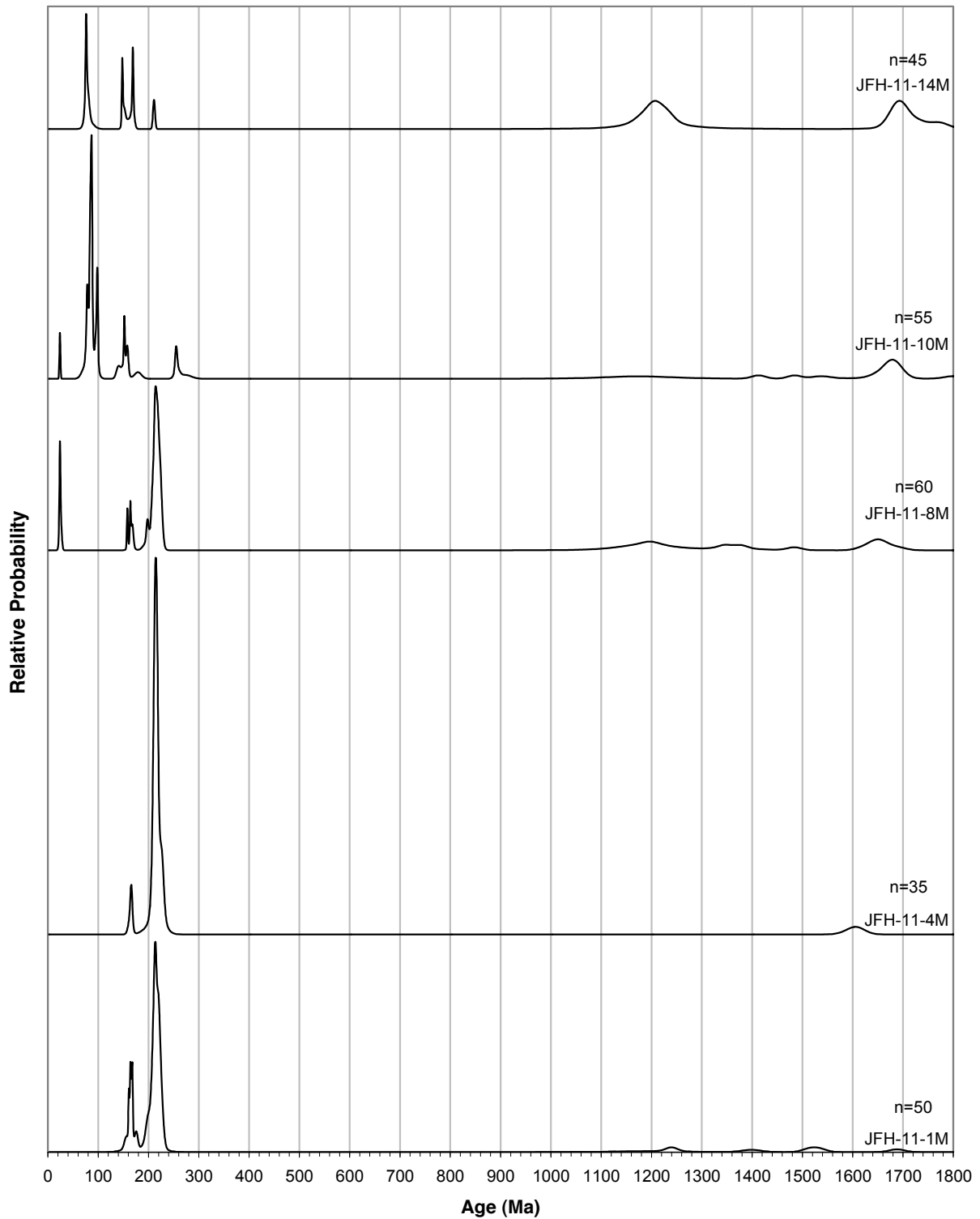


Figure 7: Probability age-distribution of Mint Canyon detrital zircons in the schist group.

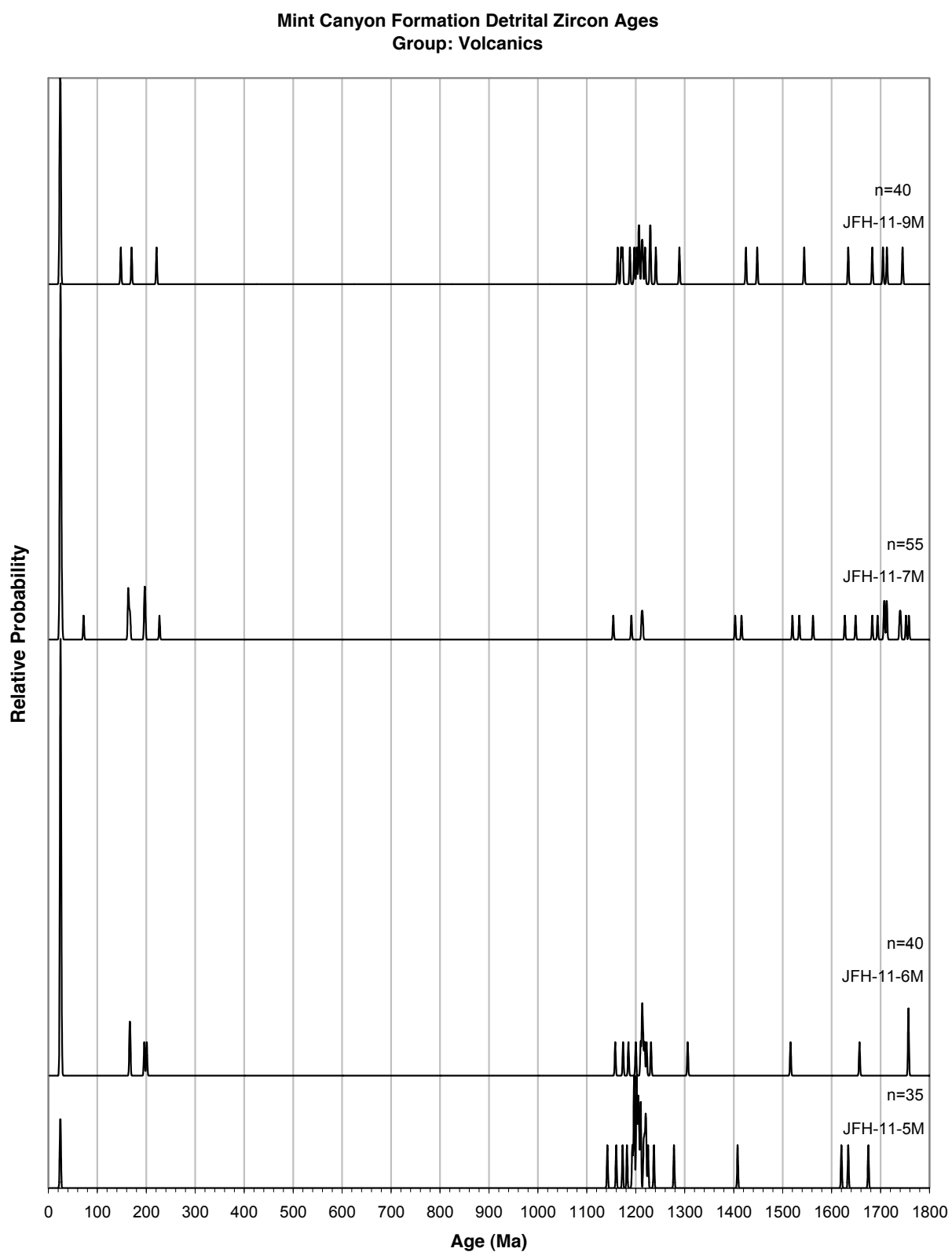


Figure 8: Probability age-distribution of Mint Canyon detrital zircons in the volcanics group.

Caliente Formation Detrital Zircon Ages
Group: Plutonic

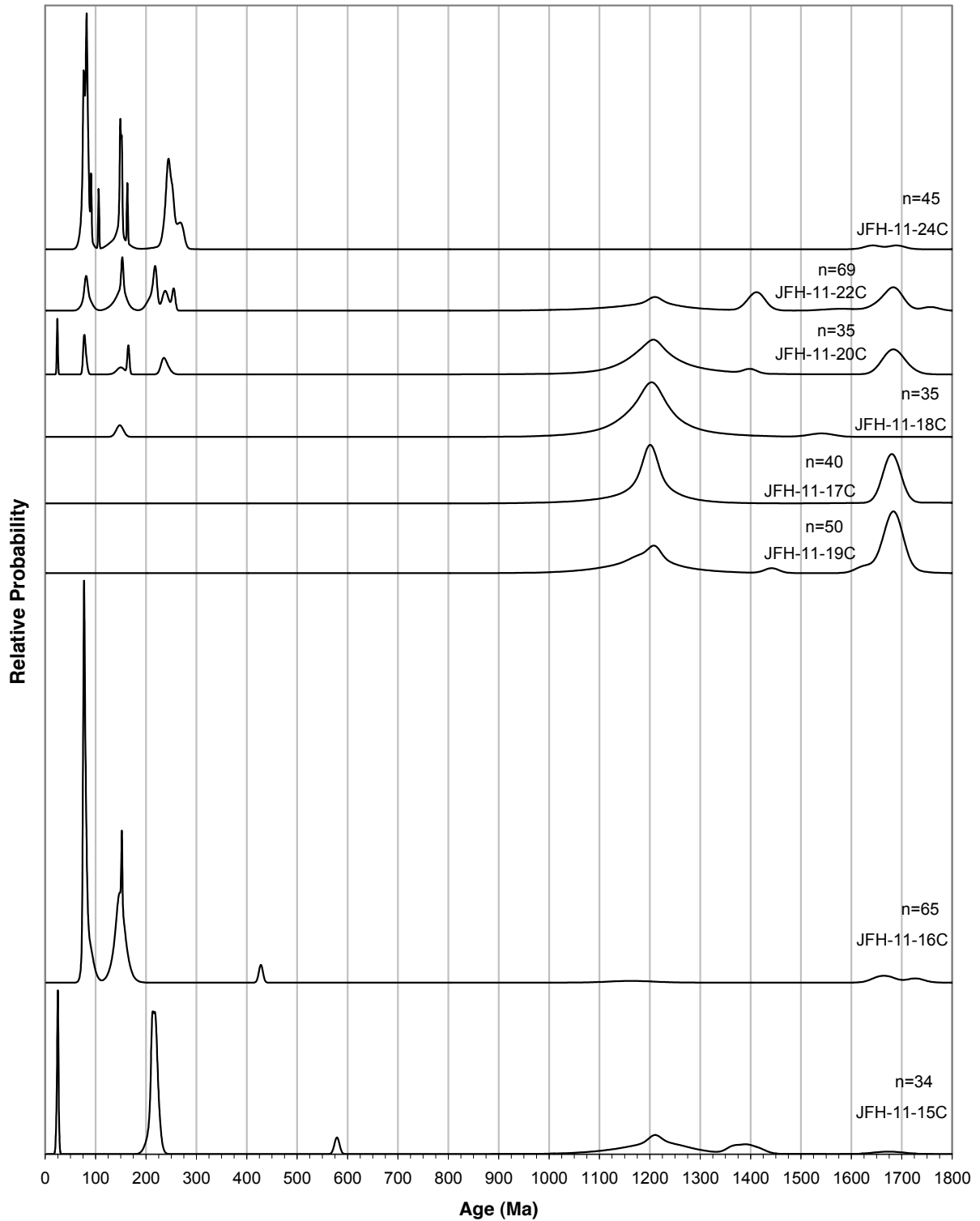


Figure 9: Probability age-distribution of Caliente detrital zircons in the plutonics group.

Palinspastic Reconstruction: Southern California (18 Ma)

Figure 10: Palinspastic reconstruction of part of southern California at 18 Ma. Major faults and formations related to the Mint Canyon and Caliente Formation are shown as present outcrops. Ages of fault slip shown; fault slip and rotation of the Transverse Ranges and Middle Miocene formations have been reversed, but regional shortening has not been reconstructed. See Figure 11 for location.

Map Key

- Contact
- Upper-plate normal fault
- Orocoipa detachment, San Francisco and Pelona
- Other currently exposed faults
- Faults covered by or cutting Upper Miocene and
- Inferred faults
- Formations
- Middle Miocene nonmarine strata: Mint Canyon
- Uppermost Oligocene-Lower Miocene nonmarine
- Simmier (Ts), Vasquez (Tv), Diligencia (Td), and
- Cretaceous-Paleogene marine strata: San Fran
- Formations (Tm) and related units.
- Upper Plate: Proterozoic-Mesozoic Crystalline B
- Lower Plate: Cretaceous-Paleogene Orocoipa (O

Palinspastic Reconstruction: Southern California (18 Ma)

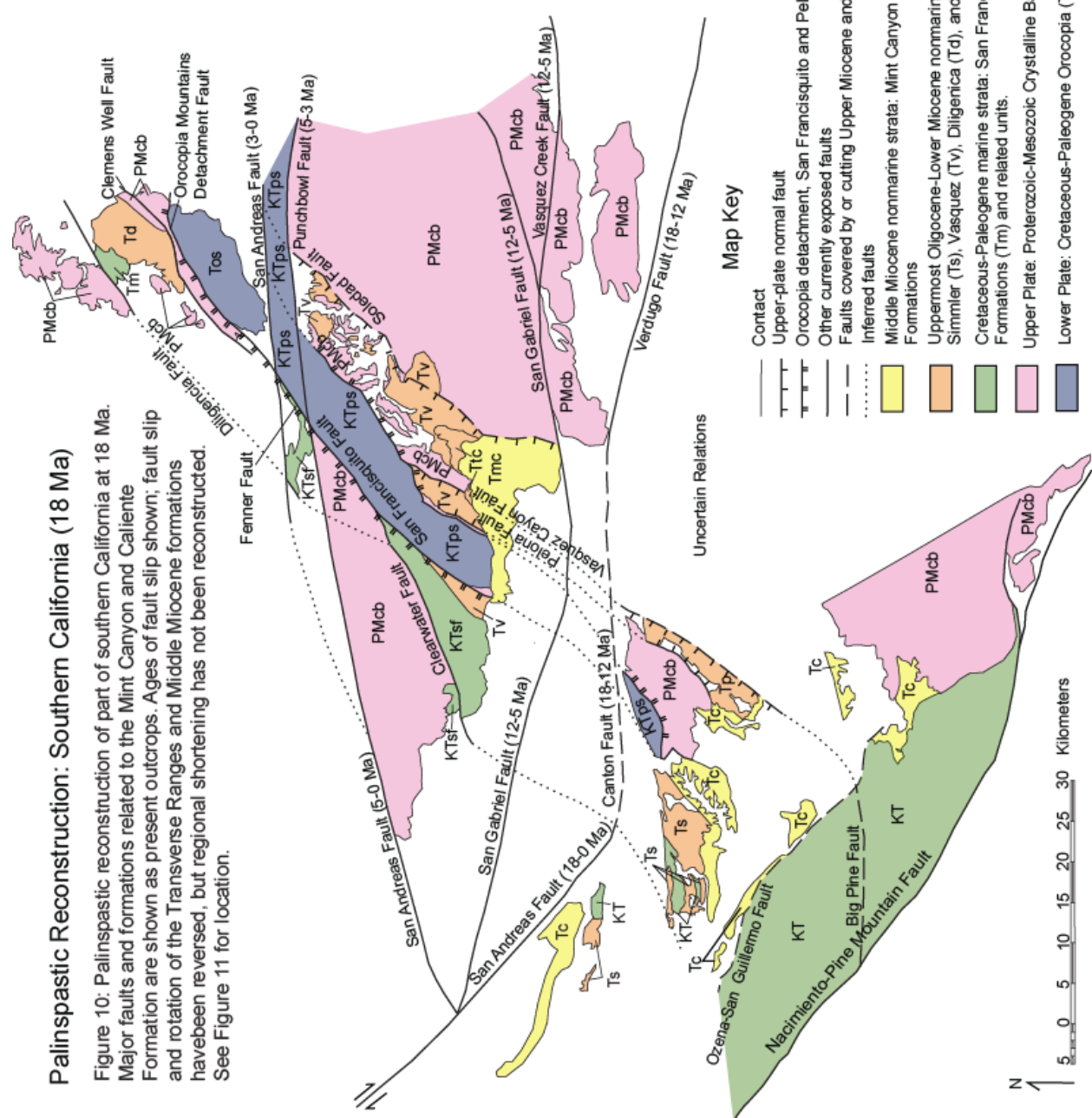
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Map Key

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- Formations (Tm) and related units.
- Upper Plate: Proterozoic-Mesozoic Crystalline B
- Lower Plate: Cretaceous-Paleogene Orocoipa (C)

Uncertain Relations

0 5 10 15 20 25 30 Kilometers



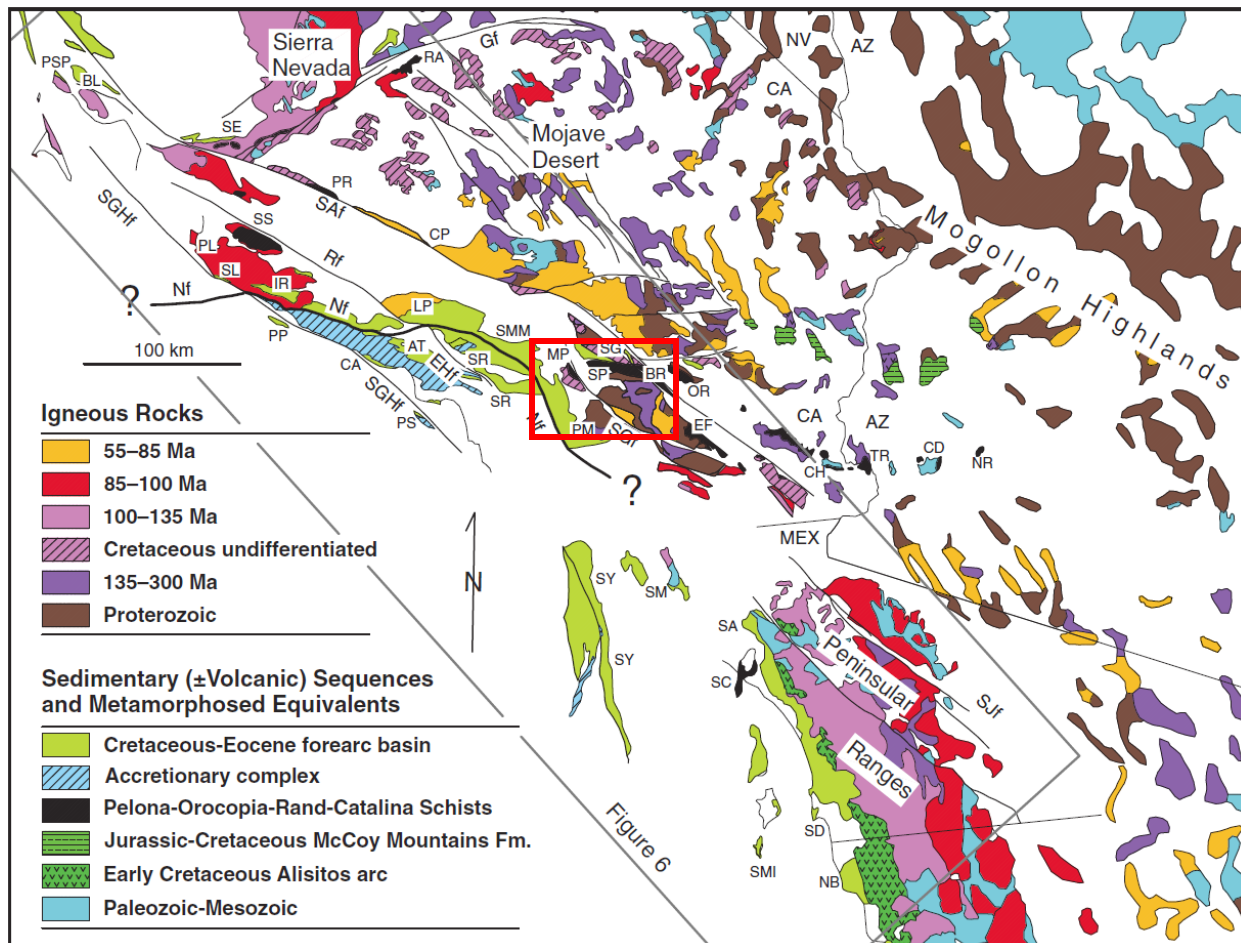


Figure 11: Pre-Miocene palinspastic reconstruction of southern California developed by Jacobson et al. (2011) that shows locations and ages of basement rocks, but does not unrotate the Transverse Ranges. SAf and SGf are San Andreas and San Gabriel faults, respectively. Approximate area of Figure 10 is located in red box.

TABLES

Table 1: Sandstone point-count categories and recalculated parameters

	Grain Type	Description
	Qm	Monocrystalline quartz
	Qp	polycrystalline quartz
	Fp	Plagioclase feldspar
	Fk	Potassium feldspar
	M	Phyllosilicate grain
	D	Dense mineral grain
	Misc	unidentified grain
Lithic Grains		
Volcanic and Hypabyssal	Lvm	Microlitic Volcanic Lithic; matix of spiky feldpar microlites
	Lvl	Lathwork Volcanic Lithic; fine-grained matrix with laths of feldspar phenocrysts
	Lvg	Granular felsitic volcanic lithic; equigranular
	Lvs	Seriate felsitic volcanic lithic; grains of varying sizes
	Lvv	Vitric Volcanic lithic
Metamorphic	Lma	Aggregate Metamorphic Lithic; microgranular aggregate of any combination of quartz, mica, and feldspar
	Lmt	Tectonic Metamorphic Lithic; individual grains within the aggregate show a preferred orientation
	Lmm	Micaceous Metamorphic Lithic; aggregate of microgranular mica crystals
Sedimentary	Lss	Silicic Sedimentary Lithic; clay matrix with angular microclasts
	Lsc	Carbonate Sedimentary Lithic; detrital carbonate grain or carbonate matrix of recycled sedimentary lithic

Sandstone Abbreviations	$Q = Qm + Qp$	$Lm = Lma + Lmt + Lmm$
	$F = Fp + Fk$	$Lv = Lvl + Lvm + Lvg + Lvs$
	$L = Lm + Lv + Ls$	$Ls = Lss + Lsc$
Sandstone Recalculated Parameters	$QFL\%Q = 100 \cdot Q / (Q + F + L)$	$LmLvLs\%Lm = 100 \cdot Lm / (Lm + Lv + Ls)$
	$QFL\%F = 100 \cdot F / (Q + F + L)$	$LmLvLs\%Lv = 100 \cdot Lv / (Lm + Lv + Ls)$
	$QFL\%L = 100 \cdot L / (Q + F + L)$	$LmLvLs\%Ls = 100 \cdot Ls / (Lm + Lv + Ls)$
	$QmFkFp\%Qm = 100 \cdot Qm / (Qm + Fk + Fp)$	
	$QmFkFp\%Fk = 100 \cdot Fk / (Qm + Fk + Fp)$	
	$QmFkFp\%Fp = 100 \cdot Fp / (Qm + Fk + Fp)$	

Table 2: Recalculated sandstone parameters

Sample	Formation	Petrofacies	Fp/F	M%	D%	QFL%Q	QFL%F	QFL%L
JFH-11-1M	Mint Canyon	S	0.813	1.0	8.7	12.6	71.4	16.0
JFH-11-3M	Mint Canyon	P	0.529	4.0	6.3	41.7	51.9	6.4
JFH-11-4M	Mint Canyon	S	0.838	2.0	12.7	12.5	70.2	17.3
JFH-11-5M	Mint Canyon	V	0.577	0.7	1.7	15.0	55.6	29.4
JFH-11-6M	Mint Canyon	V	0.914	0.0	4.3	1.1	20.4	78.6
JFH-11-7M	Mint Canyon	V	0.867	1.7	13.3	4.0	63.5	32.5
JFH-11-8M	Mint Canyon	S	0.483	1.3	6.3	15.9	72.8	11.2
JFH-11-9M	Mint Canyon	V	0.636	5.7	6.7	11.8	70.0	18.3
JFH-11-10M	Mint Canyon	S	0.500	5.3	5.0	47.8	37.3	14.9
JFH-11-12M	Mint Canyon	P	0.670	1.0	8.0	9.5	83.2	7.3
JFH-11-13M	Mint Canyon	P	0.648	1.7	9.7	20.6	68.3	11.1
JFH-11-14M	Mint Canyon	S	0.398	2.0	2.3	52.6	41.1	6.3
JFH-11-15C	Caliente	P	0.593	1.0	7.0	15.7	74.5	9.9
JFH-11-16C	Caliente	P	0.504	7.0	4.3	35.5	49.4	15.1
JFH-11-17C	Caliente	P	0.555	19.3	5.7	48.9	48.9	2.2
JFH-11-18C	Caliente	P	0.462	5.3	4.3	45.4	48.7	5.9
JFH-11-19C	Caliente	P	0.519	0.0	4.3	38.5	55.9	5.6
JFH-11-20C	Caliente	P	0.462	5.3	3.0	52.0	43.6	4.4
JFH-11-21C	Caliente	P	0.343	1.0	2.3	49.3	48.3	2.4
JFH-11-22C	Caliente	P	0.364	2.7	1.7	38.0	57.5	4.5
JFH-11-23C	Caliente	P	0.583	0.3	1.0	34.6	63.4	2.0
JFH-11-24C	Caliente	P	0.549	0.0	1.3	44.3	55.4	0.3

Sample	Formation	Petrofacies	QmFkFp %Qm	QmFkF p%Fk	QmFkFp %Fp	LmLvLs %Lm	LmLvLs %Lv	LmLvLs %Ls
JFH-11-1M	Mint Canyon	S	15.0	15.9	69.0	25.6	58.1	16.3
JFH-11-3M	Mint Canyon	P	43.9	26.4	29.7	70.6	5.9	23.5
JFH-11-4M	Mint Canyon	S	15.2	13.7	71.1	50.0	38.6	11.4
JFH-11-5M	Mint Canyon	V	17.3	35.0	47.7	5.8	40.7	53.5
JFH-11-6M	Mint Canyon	V	4.9	8.2	86.9	4.9	89.3	5.8
JFH-11-7M	Mint Canyon	V	5.4	12.6	82.0	2.5	46.9	50.6
JFH-11-8M	Mint Canyon	S	17.6	42.6	39.8	29.0	19.4	51.6
JFH-11-9M	Mint Canyon	V	13.6	31.5	54.9	29.2	4.2	66.7
JFH-11-10M	Mint Canyon	S	54.3	22.8	22.8	97.5	0.0	2.5
JFH-11-12M	Mint Canyon	P	8.1	30.4	61.5	50.0	35.0	15.0
JFH-11-13M	Mint Canyon	P	22.8	27.2	50.0	0.0	93.1	6.9
JFH-11-14M	Mint Canyon	S	55.8	26.6	17.6	50.0	0.0	50.0
JFH-11-15C	Caliente	P	16.4	34.0	49.6	22.2	37.0	40.7
JFH-11-16C	Caliente	P	41.3	29.1	29.6	7.5	2.5	90.0
JFH-11-17C	Caliente	P	49.1	22.7	28.2	40.0	40.0	20.0
JFH-11-18C	Caliente	P	47.2	28.4	24.4	37.5	43.8	18.8
JFH-11-19C	Caliente	P	40.1	28.8	31.1	43.8	31.3	25.0
JFH-11-20C	Caliente	P	51.0	26.3	22.6	25.0	50.0	25.0
JFH-11-21C	Caliente	P	49.8	33.0	17.2	0.0	85.7	14.3
JFH-11-22C	Caliente	P	38.9	38.9	22.2	0.0	100.0	0.0
JFH-11-23C	Caliente	P	35.3	27.0	37.7	16.7	83.3	0.0
JFH-11-24C	Caliente	P	44.4	25.1	30.5	0.0	100.0	0.0

Table 3: Log-transformed sandstone data.

Sample	Petrofacies	LOGQpQm	LOGFkQm	LOGFpQm	LOGLvgQm	LOGLvsQm
JFH-11-1M	S	-1.83	0.02	0.66	-0.69	-0.63
JFH-11-3M	P	-1.56	-0.22	-0.17	-2.03	-2.33
JFH-11-4M	S	-1.81	-0.04	0.67	-0.66	-0.81
JFH-11-5M	V	-0.53	0.31	0.44	-0.63	-0.42
JFH-11-6M	V	-0.78	0.22	1.25	1.07	1.49
JFH-11-7M	V	-0.95	0.37	1.18	-1.26	-1.26
JFH-11-8M	S	-1.63	0.38	0.35	-1.93	-1.93
JFH-11-9M	V	-1.16	0.36	0.61	-1.46	-1.76
JFH-11-10M	S	-1.12	-0.38	-0.38	-2.38	-2.38
JFH-11-12M	P	-0.52	0.57	0.88	-1.60	-1.60
JFH-11-13M	P	-1.72	0.08	0.34	-2.03	-2.03
JFH-11-14M	S	-1.87	-0.32	-0.50	-2.47	-2.47
JFH-11-15C	P	-1.12	0.32	0.48	-0.90	-1.90
JFH-11-16C	P	-1.66	-0.15	-0.14	-1.96	-2.26
JFH-11-17C	P	-1.42	-0.34	-0.24	-1.72	-2.33
JFH-11-18C	P	-1.37	-0.22	-0.29	-1.59	-1.47
JFH-11-19C	P	-1.55	-0.14	-0.11	-1.43	-2.33
JFH-11-20C	P	-0.84	-0.29	-0.35	-1.62	-1.62
JFH-11-21C	P	-1.54	-0.18	-0.46	-1.84	-1.54
JFH-11-22C	P	-1.42	0.00	-0.24	-1.54	-2.02
JFH-11-23C	P	-2.31	-0.12	0.03	-2.31	-1.31
JFH-11-24C	P	-2.42	-0.25	-0.16	-2.42	-2.12

Sample	Petrofacies	LOGLvmQm	LOGLviQm	LOGLmmQm	LOGLmtQm	LOQLmaQm
JFH-11-1M	S	-0.53	-1.83	-0.75	-1.83	-0.83
JFH-11-3M	P	-2.33	-2.33	-1.43	-1.43	-1.43
JFH-11-4M	S	-0.81	-1.81	-0.46	-1.81	-0.46
JFH-11-5M	V	-0.39	-1.83	-0.93	-1.83	-1.53
JFH-11-6M	V	1.34	0.30	0.30	0.12	-0.48
JFH-11-7M	V	0.48	0.09	-0.95	-1.26	-0.95
JFH-11-8M	S	-0.86	-1.93	-0.93	-1.93	-1.03
JFH-11-9M	V	-1.46	-1.76	-0.76	-1.76	-0.51
JFH-11-10M	S	-2.38	-2.38	-0.80	-1.17	-1.00
JFH-11-12M	P	-0.46	-1.60	-1.00	-1.30	-0.46
JFH-11-13M	P	-0.36	-1.12	-2.03	-2.03	-2.03
JFH-11-14M	S	-2.47	-2.47	-1.70	-2.17	-1.47
JFH-11-15C	P	-1.30	-1.12	-1.00	-1.90	-1.30
JFH-11-16C	P	-2.26	-2.26	-1.66	-2.26	-1.96
JFH-11-17C	P	-2.33	-2.33	-1.72	-2.33	-2.33
JFH-11-18C	P	-2.37	-2.37	-1.77	-1.77	-1.77
JFH-11-19C	P	-2.03	-2.33	-1.25	-2.33	-2.03
JFH-11-20C	P	-2.39	-2.39	-2.09	-2.39	-1.79
JFH-11-21C	P	-2.44	-2.44	-2.44	-2.44	-2.44
JFH-11-22C	P	-1.07	-2.32	-2.32	-2.32	-2.32
JFH-11-23C	P	-2.31	-2.31	-2.01	-2.31	-2.31
JFH-11-24C	P	-2.42	-2.42	-2.42	-2.42	-2.42

Table 3 (continued)

Sample	Petrofacies	LOGLssQm	LOGLscQm	LOGMQm	LOGDQm
JFH-11-1M	S	-1.23	-0.83	-1.05	-0.12
JFH-11-3M	P	-1.43	-2.33	-0.95	-0.75
JFH-11-4M	S	-1.81	-0.81	-0.73	0.07
JFH-11-5M	V	-0.08	-0.28	-1.23	-0.83
JFH-11-6M	V	0.52	0.00	-0.78	0.64
JFH-11-7M	V	0.60	-0.26	-0.26	0.65
JFH-11-8M	S	-0.55	-1.03	-1.03	-0.35
JFH-11-9M	V	-0.16	-0.38	-0.23	-0.16
JFH-11-10M	S	-2.38	-2.08	-0.87	-0.90
JFH-11-12M	P	-1.00	-1.30	-0.82	0.08
JFH-11-13M	P	-1.72	-1.72	-1.03	-0.26
JFH-11-14M	S	-1.22	-2.47	-1.40	-1.33
JFH-11-15C	P	-0.76	-1.00	-1.12	-0.28
JFH-11-16C	P	-2.26	-0.41	-0.64	-0.85
JFH-11-17C	P	-2.33	-2.03	-0.26	-0.79
JFH-11-18C	P	-1.77	-2.07	-0.87	-0.96
JFH-11-19C	P	-1.55	-2.03	-2.33	-0.92
JFH-11-20C	P	-1.79	-2.09	-0.89	-1.14
JFH-11-21C	P	-2.14	-2.44	-1.67	-1.30
JFH-11-22C	P	-2.32	-2.32	-1.12	-1.32
JFH-11-23C	P	-2.31	-2.31	-2.01	-1.53
JFH-11-24C	P	-2.42	-2.42	-2.42	-1.52

Table 4: Log-transformed conglomerate data.

Mint Canyon Station number	Petrofacies	LOGTvO	LOGAnSyO	LOGLO	LOGPsO
1	S	-0.19	-1.53	-1.83	0.11
2	S	0.01	-1.56	-1.86	-0.12
3	O	0.15	-0.62	0.13	-1.70
4	O	-0.29	-0.92	-2.03	-0.65
5	O	-0.21	-0.54	-0.85	-0.48
6	S	-0.39	-1.73	-1.73	-0.37
7	S	-0.64	-1.79	-2.09	-0.39
8	S	-0.57	-1.80	-2.10	-0.50
9	S	0.00	0.30	0.00	2.30
10	S	-0.66	-1.74	-2.04	-0.22
11	S	-0.60	-1.81	-2.11	-0.51
12	S	-1.20	-1.40	-2.10	-0.31
13	S	-2.07	-1.77	-2.07	-0.16
14	S	-2.15	-1.45	-2.15	-0.42
15	P	1.26	1.01	0.56	-0.78
16	P	0.15	0.01	-1.76	-1.76
17	S	-0.80	-1.71	-2.01	-0.09
18	P	-0.79	-1.87	-2.17	-0.72
19	P	1.39	0.82	0.00	-0.78
20	S	2.04	1.51	1.56	1.34
21	S	-2.08	-1.78	-2.08	-0.18
22	S	-0.45	-1.71	-2.01	-0.22
23	S	-2.06	-1.76	-2.06	-0.14
24	S	-0.41	-1.59	-1.89	0.07
25	S	-0.76	-1.46	-1.76	0.36
26	S	-0.46	-1.54	-1.85	0.18
27	S	-0.28	-1.66	-1.96	-0.19
28	S	-2.03	-1.73	-2.03	-0.07
29	S	-0.69	-1.77	-2.07	-0.18
30	S	-0.41	-1.73	-2.03	-0.33
31	P	1.98	1.56	1.83	0.00
32	P	0.50	-0.05	0.33	-1.45
33	P	1.11	0.63	0.83	-0.90
34	S	1.69	-0.30	-0.60	-0.60
35	V	0.00	0.30	0.00	2.30
36	V	2.30	0.30	0.00	0.00
37	P	1.38	-0.60	-0.90	-0.90
38	V	0.80	0.27	0.71	-1.15
39	V	0.75	-1.18	-1.48	-1.48
40	V	1.12	-0.85	-1.15	-1.15
41	S	1.69	-0.30	-0.60	-0.60
42	S	-0.85	-1.70	-2.00	-0.07
43	S	-0.45	-1.23	-1.53	0.66
44	S	-1.20	-1.90	-2.20	-0.86
45	S	-0.76	-0.82	-1.06	0.47
46	S	0.00	0.30	0.00	2.30
47	S	-1.08	-0.78	0.30	1.14

Table 4 (continued)

48	P	-0.51	0.00	0.06	-1.76
49	P	-0.11	0.05	0.21	-1.64
50	P	-0.43	0.18	0.11	-1.68
51	P	-0.23	0.06	-0.14	-1.76
52	P	0.01	-0.46	-0.18	-1.82
53	O	0.33	-0.65	0.22	-1.60
54	O	-0.43	-1.86	-2.16	-2.16
55	V	1.69	-0.30	-0.30	-0.60
56	V	2.30	0.30	0.00	0.00
57	O	0.34	-0.74	0.12	-1.64
58	V	1.69	-0.30	-0.60	-0.60
59	O	0.23	-1.36	0.22	-1.66
60	O	0.53	-0.81	0.24	-1.51
61	O	0.15	-1.29	0.00	-1.76
62	O	0.32	-1.46	-0.42	-1.76
63	V	1.69	-0.30	-0.60	-0.60
64	O	0.82	-0.40	0.30	-1.30
65	O	-0.06	-1.03	-0.90	-1.98
66	O	-0.32	-1.60	-0.78	-2.08
67	O	0.74	-0.43	0.18	-1.38
68	V	1.06	-0.90	-1.20	-1.20
69	V	1.99	0.00	0.00	-0.30
70	V	1.18	-0.30	-1.08	-1.08
71	V	1.04	-0.90	-0.30	-1.20
72	V	2.00	0.00	-0.30	-0.30
73	V	0.55	-1.34	-1.64	-1.64
74	O	-0.14	-1.76	-1.45	-2.06
75	O	-0.12	-1.70	-0.62	-2.00
76	V	0.91	-1.04	-1.34	-1.34
77	V	1.00	-0.95	-1.26	-1.26
78	V	1.06	-0.90	-0.90	-1.20
79	V	0.76	-0.41	-1.45	-1.45
80	V	0.74	-1.18	-0.88	-1.48
81	V	1.19	-0.78	-1.08	-1.08
82	V	1.19	-0.78	-0.48	-1.08
83	O	1.18	-0.70	0.60	-1.00
84	S	2.08	0.30	1.34	1.76
85	V	0.99	-0.95	-0.48	-1.26
87	V	1.12	-0.85	-0.85	-1.15
88	O	-0.56	-1.16	-1.56	-2.16
89	O	0.04	-0.69	-0.39	-1.87
90	P	0.49	0.33	-0.33	-1.48
91	O	0.10	-0.84	-0.08	-1.79
92	S	1.85	0.95	1.60	1.91
93	O	0.21	-0.56	-0.09	-1.73
94	S	1.51	0.54	1.28	1.65
95	S	0.75	-0.78	0.52	0.82
96	V	1.12	-0.85	-0.85	-1.15
97	V	1.69	-0.30	-0.60	-0.60
98	V	2.30	0.30	0.00	0.00
99	V	1.69	-0.12	-0.60	-0.60

Table 4 (continued)

100	O	0.73	-0.33	-0.15	-1.45
101	O	0.45	-0.60	-0.05	-1.60
102	O	0.51	-0.69	0.17	-1.53
103	V	1.00	-0.95	-0.95	-1.26
104	V	1.66	0.51	-0.60	-0.60
107	P	0.03	-0.12	0.59	-1.48
108	O	-0.68	-1.65	-0.57	-2.13
109	P	-1.20	0.16	-0.20	-1.81
110	P	-2.03	-0.25	-0.47	-2.03
111	P	-0.46	-0.28	-0.20	-1.90
112	P	-1.07	-0.02	-0.08	-1.85
113	P	-0.60	-0.34	-0.43	-1.98
114	P	0.34	0.19	0.29	-1.48
115	P	1.51	0.88	-0.48	-0.78
117	P	-1.20	1.06	-1.20	-1.20
118	V	1.48	-0.48	0.30	-0.78
Caliente Station number	Petrofacies				
3	O	0.43	-0.78	-0.48	-1.68
4	O	0.74	-0.34	-0.11	-1.41
5	O	0.99	-0.08	0.67	-0.48
7	O	0.94	-0.18	-0.26	-0.95
8	V	1.44	-0.08	0.22	0.37
9	V	1.01	0.00	0.00	0.00
10	V	1.16	-0.78	-0.18	-0.18
11	O	0.56	-0.58	-0.03	-1.23
12	O	0.95	0.00	0.00	-0.20

Table 5: Mint Canyon and Caliente conglomerate and sandstone discriminant analysis classical classification and jackknifed matrices of the final Systat iteration are shown below. F-to-remove variables are shown with corresponding values used by the discriminant analysis program, and canonical scores of group means are also shown.

Discriminant Analysis Data

Conglomerate:						Sandstone:					
Classical classification matrix						Classical classification Matrix					
	P	O	S	V	%correct		P	S	V	%correct	
P	22	0	0	1	96	P	13	0	0	100	
O	0	29	2	2	88	S	0	5	0	100	
S	0	0	32	0	100	V	0	0	4	100	
V	0	0	0	35	100	Total	13	5	4	100	
Total	22	29	34	38	96						
Jackknifed classification matrix						Jackknifed classification matrix					
	P	O	S	V	%correct		P	S	V	%correct	
P	22	0	0	1	96	P	12	0	1	92	
O	0	28	2	3	85	S	1	4	0	80	
S	0	0	32	0	100	V	1	1	2	50	
V	0	0	0	35	100	Total	14	5	3	82	
Total	22	28	34	39	95						
Variable F-to-remove						Variable F-to-remove					
LOGTVO	66.98					LOGQPQM	4.76				
LOGLO	10.65					LOGFPQM	16.54				
LOGANSYO	63.88					LOGLVGQM	4.49				
LOGPSO	203.15					LOGLVSQM	3.78				
						LOGQVMQM	11.07				
						LOGLMMQM	6.05				
						LOGLMTQM	7.00				
						LOGLMAQM	8.21				
						LOGLSSQM	3.87				

Conglomerate: Canonical scores of group means

	Factor 1	Factor 2	Factor 3
P	3.7	-1.646	0.604
O	1.305	-0.028	-0.928
S	-4.339	-0.871	0.111
V	0.305	1.904	0.377

Sandstone: Canonical scores of group means

	Factor 1	Factor 2
P	1.995	-0.733
S	-5.06	-0.838
V	-0.159	3.43

APPENDIX A: RAW CONGLOMERATE DATA

Mint Canyon Station number	Ehler's (2000) Categories	Assigned Petrofacies	Tv	L	An	Sy	Ps	O	Total Count
1	P	S	22	0	0	0	44	34	100
2	P	S	37	0	0	0	27	36	100
3	A	O	35	34	5	1	0	25	100
4	O	O	28	0	6	0	12	54	100
5	A	O	26	6	10	2	14	42	100
6	P	S	22	1	0	0	23	54	100
7	P	S	14	0	0	0	25	61	100
8	P	S	17	0	0	0	20	63	100
9	P	S	0	0	0	0	100	0	100
10	P	S	12	0	0	0	33	55	100
11	P	S	16	0	0	0	20	64	100
12	P	S	4	0	0	2	31	63	100
13	P	S	0	0	0	0	41	59	100
14	P	S	0	0	0	2	27	71	100
15	A	P	55	11	27	4	0	3	100
16	A	P	41	0	14	16	0	29	100
17	P	S	8	0	0	0	41	51	100
18	O	P	12	0	0	0	14	74	100
19	A	P	74	3	15	5	0	3	100
20	A	S	55	18	12	4	11	0	100
21	P	S	0	0	0	0	40	60	100
22	P	S	18	0	0	0	31	51	100
23	P	S	0	0	0	0	42	58	100
24	P	S	15	0	0	0	46	39	100
25	P	S	5	0	0	0	66	29	100
26	P	S	12	0	0	0	53	35	100
27	P	S	24	0	0	0	30	46	100
28	P	S	0	0	0	0	46	54	100
29	P	S	12	0	0	0	39	59	110
30	P	S	21	0	0	0	25	54	100
31	A	P	48	34	14	4	0	0	100
32	A	P	44	30	12	0	0	14	100
33	A	P	52	27	16	1	0	4	100
34	V	S	98	0	0	0	0	2	100
35	P	V	0	0	0	0	100	0	100
36	V	V	100	0	0	0	0	0	100
37	V	P	96	0	0	0	0	4	100
38	A	V	44	36	12	1	0	7	100
39	O	V	85	0	0	0	0	15	100
40	V	V	93	0	0	0	0	7	100
41	V	S	98	0	0	0	0	2	100
42	P	S	7	0	0	0	43	50	100
43	P	S	6	0	0	0	77	17	100
44	O	S	5	0	4	0	11	80	100
45	P	S	4	2	0	3	68	23	100
46	P	S	0	0	0	0	100	0	100
47	P	S	0	12	0	0	82	6	100
48	A	P	9	33	28	1	0	29	100
49	A	P	17	36	24	0	0	22	99
50	A	P	9	31	36	0	0	24	100
51	A	P	17	21	33	0	0	29	100
52	A	P	34	22	11	0	0	33	100
53	O	O	43	33	4	0	0	20	100
54	O	O	27	0	0	0	0	73	100

55	V	V	97	1	0	0	0	2	100
56	V	V	100	0	0	0	0	0	100
57	O	O	48	29	3	1	0	22	103
58	V	V	98	0	0	0	0	2	100
59	O	O	39	38	0	0	0	23	100
60	O	O	54	28	2	0	0	16	100
61	O	O	41	29	1	0	0	29	100
62	O	O	60	11	0	0	0	29	100
63	V	V	98	0	0	0	0	2	100
64	O	O	66	20	3	1	0	10	100
65	O	O	42	6	4	0	0	48	100
66	O	O	29	10	1	0	0	60	100
67	O	O	66	18	4	0	0	12	100
68	V	V	92	0	0	0	0	8	100
69	V	V	98	1	0	0	0	1	100
70	V	V	91	0	2	1	0	6	100
71	O	V	88	4	0	0	0	8	100
72	V	V	99	0	0	0	0	1	100
73	O	V	78	0	0	0	0	22	100
74	O	O	41	2	0	0	0	57	100
75	O	O	38	12	0	0	0	50	100
76	O	V	89	0	0	0	0	11	100
77	V	V	91	0	0	0	0	9	100
78	V	V	91	1	0	0	0	8	100
79	O	V	81	0	5	0	0	14	100
80	V	V	83	2	0	0	0	15	100
81	V	V	94	0	0	0	0	6	100
82	V	V	92	2	0	0	0	6	100
83	O	O	75	20	0	0	0	5	100
84	P	S	60	11	0	0	29	0	100
85	O	V	88	3	0	0	0	9	100
87	V	V	92	1	0	0	0	7	100
88	O	O	20	2	4	1	0	73	100
89	O	O	41	15	7	0	0	37	100
90	A	P	46	7	31	1	0	15	100
91	O	O	39	26	4	0	0	31	100
92	P	S	35	20	4	0	41	0	100
93	O	O	44	22	7	0	0	27	100
94	P	S	32	19	3	0	45	1	100
95	P	S	34	20	0	0	40	6	100
96	V	V	92	1	0	0	0	7	100
97	V	V	98	0	0	0	0	2	100
98	V	V	100	0	0	0	0	0	100
99	V	V	97	0	1	0	0	2	100
100	O	O	75	10	6	0	0	14	105
101	O	O	57	18	4	1	0	20	100
102	O	O	55	25	3	0	0	17	100
103	V	V	91	1	0	0	0	9	101
104	V	V	92	0	6	0	0	2	100
107	A	P	16	58	11	0	0	15	100
108	O	O	14	18	1	0	0	67	100
109	A	P	2	20	43	3	0	32	100
110	A	P	0	18	29	0	0	53	100
111	A	P	14	25	20	1	0	40	100
112	A	P	3	29	33	0	0	35	100
113	A	P	12	18	21	1	0	48	100
114	A	P	33	29	22	1	0	15	100
115	A	P	96	1	22	1	0	3	123

117	A	P	0	0	92	0	0	8	100
118	V	V	91	6	0	0	0	3	100
Caliente Station number		Petrofacies	Tv	L	An	Sy	Ps	O	Total Count
3	N/A	O	64	8	2	2	0	24	100
4	N/A	O	71	10	3	3	0	13	100
5	N/A	O	59	28	3	2	2	6	100
7	N/A	O	79	5	2	4	1	9	100
8	N/A	V	83	5	0	2	7	3	100
9	N/A	V	72	7	4	3	7	7	100
10	N/A	V	86	4	0	0	4	6	100
11	N/A	O	62	16	0	4	1	17	100
12	N/A	O	71	8	2	6	5	8	100

APPENDIX B: RAW SANDSTONE DATA

Sample	Formation	Petrofacies	Qp	Qm	Fp	Fk	Lvg	Lvs	Lvm	Lvl	Lmm	Lmt	Lma	Lss	Lsc	M	D	Misc.
JFH-11-1M	Mint Canyon	S	0	34	156	36	7	8	10	0	6	0	5	2	5	3	26	2
JFH-11-3M	Mint Canyon	P	3	108	73	65	1	0	0	0	4	4	4	4	0	12	19	3
JFH-11-4M	Mint Canyon	S	0	32	150	29	7	5	5	0	11	0	11	0	5	6	38	1
JFH-11-5M	Mint Canyon	V	10	34	94	69	8	13	14	0	4	0	1	28	18	2	5	0
JFH-11-6M	Mint Canyon	V	0	3	53	5	35	93	66	6	6	4	1	10	3	0	13	2
JFH-11-7M	Mint Canyon	V	1	9	137	21	0	0	27	11	1	0	1	36	5	5	40	6
JFH-11-8M	Mint Canyon	S	1	43	97	104	0	0	6	0	5	0	4	12	4	4	19	1
JFH-11-9M	Mint Canyon	V	2	29	117	67	1	0	1	0	5	0	9	20	12	17	20	0
JFH-11-10M	Mint Canyon	S	9	119	50	50	0	0	0	0	19	8	12	0	1	16	15	1
JFH-11-12M	Mint Canyon	P	6	20	152	75	0	0	7	0	2	1	7	2	1	3	24	0
JFH-11-13M	Mint Canyon	P	1	53	116	63	0	0	23	4	0	0	0	1	1	5	29	4
JFH-11-14M	Mint Canyon	S	2	149	47	71	0	0	0	0	3	1	5	9	0	6	7	0
JFH-11-15C	Caliente	P	3	40	121	83	5	0	2	3	4	0	2	7	4	3	21	2
JFH-11-16C	Caliente	P	2	92	66	65	1	0	0	0	2	0	1	0	36	21	13	1
JFH-11-17C	Caliente	P	4	106	61	49	2	0	0	0	2	0	0	0	1	58	17	0
JFH-11-18C	Caliente	P	5	118	61	71	3	4	0	0	2	2	2	2	1	16	13	0
JFH-11-19C	Caliente	P	3	107	83	77	4	0	1	0	6	0	1	3	1	0	13	1
JFH-11-20C	Caliente	P	18	124	55	64	3	3	0	0	1	0	2	2	1	16	9	2
JFH-11-21C	Caliente	P	4	139	48	92	2	4	0	0	0	0	0	1	0	3	7	0
JFH-11-22C	Caliente	P	4	105	60	105	3	1	9	0	0	0	0	0	0	8	5	0
JFH-11-23C	Caliente	P	0	102	109	78	0	5	0	0	1	0	0	0	0	1	3	1
JFH-11-24C	Caliente	P	0	131	90	74	0	1	0	0	0	0	0	0	0	0	4	0

APPENDIX C: RAW DETRITAL-ZIRCON DATA

U-Pb geochronologic analyses

N34.41891 W118.42284

JFH-11-1M

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
112	20141	1.2	18.7116	8.1	0.5072	8.4	0.0688	1.9	0.23	429.1	8.0	417	28.6	348	184.5	429	8.0
174	37246	2.2	18.5856	7.7	0.2568	8.2	0.0346	2.8	0.34	219.4	5.9	232	16.9	363	173.5	219	5.9
481	54205	2.8	19.9511	4.9	0.2444	5.3	0.0354	1.9	0.37	224.1	4.3	222	10.6	201	114.4	224	4.3
28	9499	1.3	12.4365	6.3	2.2406	7.9	0.2021	4.7	0.60	1186.6	51.0	1194	55.4	1207	124.7	1207	124.7
75	253	0.2	19.5413	11.8	0.2375	12.8	0.0337	4.9	0.38	213.4	10.3	216	25.0	249	273.1	213	10.3
602	46947	1.5	19.6658	3.2	0.2444	3.5	0.0349	1.2	0.35	220.9	2.6	222	6.9	234	74.8	221	2.6
185	7338	2.4	19.9562	12.3	0.2330	18.6	0.0337	14.0	0.75	213.8	29.4	213	35.8	200	286.3	214	29.4
571	49687	1.3	20.7252	3.9	0.1759	4.0	0.0264	1.0	0.26	168.2	1.7	165	6.1	112	92.2	168	1.7
70	244	0.3	18.5677	14.6	0.2508	15.1	0.0338	3.9	0.26	214.1	8.2	227	30.7	365	329.8	214	8.2
265	29992	69.2	19.7718	8.0	0.2345	8.4	0.0336	2.5	0.29	213.3	5.2	214	16.2	222	185.4	213	5.2
341	46941	1.3	19.2518	3.3	0.2466	4.0	0.0344	2.3	0.58	218.2	5.0	224	8.1	283	74.5	218	5.0
663	322234	11.3	12.2236	0.6	2.3188	1.8	0.2056	1.7	0.93	1205.2	18.4	1218	12.7	1241	12.6	1241	12.6
159	18519	1.5	20.9325	8.3	0.2272	8.5	0.0345	2.2	0.26	218.6	4.7	208	16.1	88	195.9	219	4.7
427	289003	12.5	10.4876	0.5	3.4890	1.5	0.2654	1.4	0.94	1517.3	18.8	1525	11.7	1535	9.3	1535	9.3
614	70171	11.2	20.4692	3.5	0.1708	3.6	0.0254	1.0	0.27	161.4	1.6	160	5.4	141	82.5	161	1.6
280	241510	2.1	10.6051	0.7	3.1909	2.1	0.2454	2.0	0.95	1414.8	25.7	1455	16.5	1514	12.3	1514	12.3
92	4517	2.0	30.1381	37.4	0.1125	37.5	0.0246	2.8	0.07	156.6	4.3	108	38.6	-860	1107.0	157	4.3
119	64561	1.5	11.2643	1.1	2.9210	1.8	0.2386	1.5	0.81	1379.6	18.2	1387	13.6	1399	20.1	1399	20.1
59	27153	1.1	12.5093	3.0	2.0069	3.2	0.1821	1.1	0.35	1078.3	11.2	1118	21.9	1196	59.7	1196	59.7
383	320834	0.7	9.6584	0.5	4.1958	0.7	0.2939	0.5	0.73	1661.1	7.4	1673	5.7	1688	8.8	1688	8.8
126	11641	1.2	19.3836	8.8	0.2427	9.3	0.0341	3.0	0.33	216.2	6.5	221	18.5	267	202.4	216	6.5
306	45396	1.1	19.5619	3.7	0.2440	4.5	0.0346	2.6	0.57	219.3	5.5	222	8.9	246	84.5	219	5.5
101	5850	1.0	22.8485	25.8	0.1590	26.0	0.0263	3.4	0.13	167.6	5.7	150	36.2	-124	645.5	168	5.7
85	2458	1.9	19.9642	21.3	0.2415	21.5	0.0350	2.8	0.13	221.5	6.2	220	42.5	199	500.3	222	6.2
322	17923	1.8	20.4745	4.9	0.1764	5.1	0.0262	1.3	0.26	166.7	2.2	165	7.8	140	115.9	167	2.2
238	19552	2.9	20.5824	5.7	0.2214	6.0	0.0331	1.9	0.31	209.6	3.9	203	11.1	128	134.7	210	3.9
159	13929	1.6	21.9369	8.2	0.2084	8.7	0.0332	2.9	0.33	210.3	5.9	192	15.2	-24	199.3	210	5.9
61	5888	0.7	20.7702	32.8	0.2224	33.9	0.0335	8.7	0.26	212.4	18.2	204	62.7	106	792.9	212	18.2
125	10682	2.0	23.2861	18.3	0.2015	18.5	0.0340	2.0	0.11	215.8	4.3	186	31.4	-171	460.1	216	4.3
423	43873	1.4	20.6424	4.1	0.1730	4.2	0.0259	0.7	0.18	164.8	1.2	162	6.2	121	96.8	165	1.2
375	36324	2.0	20.4781	4.8	0.2265	5.0	0.0336	1.3	0.27	213.3	2.8	207	9.3	140	112.1	213	2.8
460	32642	0.8	20.4141	2.4	0.1764	3.0	0.0261	1.8	0.59	166.2	2.9	165	4.5	147	56.6	166	2.9
138	15837	2.1	20.4646	10.9	0.2288	11.0	0.0340	1.3	0.12	215.3	2.8	209	20.8	141	257.0	215	2.8
179	9313	0.9	19.8661	11.1	0.1926	11.3	0.0278	2.2	0.20	176.5	3.9	179	18.5	211	257.3	176	3.9
146	24957	1.5	20.2023	4.4	0.2403	4.8	0.0352	1.9	0.40	223.0	4.2	219	9.4	172	102.7	223	4.2
70	222	0.4	16.8067	12.2	0.2678	13.9	0.0326	6.8	0.49	207.1	13.8	241	29.9	585	265.3	207	13.8
32	100	0.2	31.9235	38.5	0.1374	39.0	0.0318	6.1	0.16	201.8	12.2	131	47.9	-1028	1185.1	202	12.2
84	8831	1.9	18.3803	13.4	0.2542	14.0	0.0339	3.7	0.27	214.8	7.9	230	28.7	388	303.1	215	7.9
99	14087	1.9	21.8004	19.1	0.2020	19.3	0.0319	2.5	0.13	202.7	5.0	187	32.9	-9	465.0	203	5.0
125	23214	2.0	20.5359	17.0	0.2293	17.2	0.0342	2.7	0.16	216.5	5.8	210	32.6	133	401.4	217	5.8
530	37964	3.0	19.8358	2.7	0.2331	3.2	0.0335	1.6	0.50	212.6	3.3	213	6.1	214	63.3	213	3.3
64	231	0.9	16.3294	12.2	0.2801	13.5	0.0332	5.8	0.43	210.4	12.0	251	30.1	648	264.0	210	12.0
424	38957	2.6	19.7362	2.6	0.2315	3.0	0.0331	1.6	0.52	210.2	3.3	211	5.8	226	60.2	210	3.3
111	13021	1.4	20.1280	11.4	0.2461	11.6	0.0359	2.0	0.18	227.5	4.5	223	23.2	180	266.4	227	4.5
59	6180	1.2	21.0822	47.5	0.1642	48.6	0.0251	10.4	0.21	159.8	16.5	154	69.7	71	1190.6	160	16.5
125	9622	3.6	20.3888	17.5	0.2360	17.6	0.0349	1.9	0.11	221.1	4.1	215	34.1	150	412.2	221	4.1
595	50358	4.6	20.1157	3.2	0.2311	3.3	0.0337	0.6	0.18	213.8	1.2	211	6.3	182	75.4	214	1.2

341	21905	2.2	20.2582	7.3	0.2130	7.6	0.0313	2.1	0.28	198.6	4.2	196	13.5	165	170.2	199	4.2
236	28468	1.9	19.4963	7.5	0.2359	7.9	0.0334	2.3	0.30	211.5	4.9	215	15.3	254	173.3	212	4.9
196	27720	0.8	19.3868	7.6	0.2480	8.1	0.0349	2.8	0.35	221.0	6.1	225	16.3	267	173.6	221	6.1
108	127778	1.3	18.5253	5.2	0.4806	5.4	0.0646	1.6	0.29	403.4	6.3	398	18.0	370	117.3	403	6.3

JFH-11-3M N34.37681 W118.43307

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
202.2	73895.06	1.213	17.85831	4.1202	0.51259	4.2732	0.06639	1.13	0.265	414.38	4.549	420	14.705	452	91.53551	414	4.549
322.3	34814.93	2.824	20.36422	2.8789	0.22033	3.9677	0.03254	2.73	0.688	206.43	5.547	202	7.2738	153	67.43838	206	5.547
164.4	602181.3	1.941	9.405271	0.617	4.4038	1.4515	0.3004	1.31	0.905	1693.3	19.57	1713	12.012	1737	11.31148	1737	11.31
173.9	28369.87	2.591	21.31231	13.916	0.21123	14.124	0.03265	2.42	0.171	207.12	4.926	195	25.015	45	333.9152	207	4.926
256.5	457312.7	0.802	9.566866	0.2588	4.20477	0.8863	0.29175	0.85	0.956	1650.3	12.34	1675	7.2705	1706	4.761812	1706	4.762
97.56	99708.91	2.144	12.53886	0.8511	2.15575	1.2391	0.19605	0.9	0.727	1154	9.515	1167	8.5947	1191	16.80162	1191	16.8
111.4	141647.6	0.945	11.34361	0.8656	2.75185	1.6855	0.2264	1.45	0.858	1315.6	17.21	1343	12.554	1386	16.62148	1386	16.62
255.9	342346.5	13.03	9.672265	0.4353	3.81422	6.6456	0.26757	6.63	0.998	1528.4	90.24	1596	53.511	1686	8.033852	1686	8.034
1282	1106855	34.11	9.926619	0.346	3.80878	1.3996	0.27421	1.36	0.969	1562.1	18.81	1595	11.256	1638	6.425031	1638	6.425
38.32	48938.93	1.295	9.507429	2.0419	4.48878	2.6286	0.30952	1.66	0.63	1738.3	25.22	1729	21.831	1717	37.53605	1717	37.54
273.3	29964.87	0.857	20.39364	7.1005	0.17305	7.1821	0.0256	1.08	0.15	162.93	1.737	162	10.759	150	166.6063	163	1.737
56.27	8962.355	1.565	29.98117	45.971	0.1611	46.082	0.03503	3.2	0.069	221.95	6.971	152	65.009	-845	1377.316	222	6.971
206.5	299263.8	0.373	12.54942	0.7781	2.22539	1.4027	0.20255	1.17	0.832	1189	12.67	1189	9.8273	1189	15.34471	1189	15.34
396.1	358447.1	4.046	9.708389	0.1583	3.86461	1.581	0.27211	1.57	0.995	1551.5	21.69	1606	12.754	1679	2.923454	1679	2.923
3471	173853.4	5.629	20.78758	1.134	0.08076	2.4159	0.01218	2.13	0.883	78.018	1.654	79	1.8331	104	26.82366	78	1.654
135.5	41556.51	2.567	20.32435	9.5855	0.23299	9.8135	0.03434	2.1	0.214	217.68	4.501	213	18.831	157	224.7616	218	4.501
491.2	96348.81	2.745	19.99464	4.7046	0.23374	5.5828	0.0339	3.01	0.538	214.88	6.352	213	10.74	196	109.3722	215	6.352
967.7	158208.2	1.075	19.46119	1.2579	0.27368	1.8007	0.03863	1.29	0.716	244.33	3.089	246	3.9288	258	28.90559	244	3.089
258.2	392481.3	1.61	10.8137	1.0946	3.10193	2.903	0.24328	2.69	0.926	1403.7	33.92	1433	22.294	1477	20.76039	1477	20.76
199.6	78228.27	2.443	21.08718	8.2773	0.22555	8.4574	0.0345	1.74	0.205	218.62	3.731	207	15.806	71	197.1444	219	3.731
140.6	172848.4	1.824	9.656413	0.8457	4.29027	1.1422	0.30047	0.77	0.672	1693.6	11.43	1691	9.4058	1689	15.6011	1689	15.6
128.9	183684.5	2.47	9.543623	0.66	4.34873	1.1792	0.30101	0.98	0.829	1696.3	14.57	1703	9.7351	1710	12.142	1710	12.14
357.2	73449.25	2.371	20.13897	5.4918	0.23796	5.7439	0.03476	1.68	0.293	220.25	3.644	217	11.211	179	128.1252	220	3.644
28.18	22315.17	0.813	12.17319	3.2849	2.22332	3.9648	0.19629	2.22	0.56	1155.4	23.48	1188	27.776	1249	64.30004	1249	64.3
257.7	40252.83	1.942	21.04455	6.6162	0.2271	6.8412	0.03466	1.74	0.254	219.66	3.758	208	12.856	75	157.3723	220	3.758
91.14	15439.57	22.27	18.80278	14.018	0.23643	14.296	0.03224	2.8	0.196	204.57	5.646	215	27.764	337	318.9931	205	5.646
176	16483.96	1.92	9.545061	0.6963	4.2125	1.7501	0.29162	1.61	0.917	1649.6	23.37	1676	14.362	1710	12.81026	1710	12.81
177.8	212132.1	1.104	12.4589	0.8597	2.19617	1.453	0.19845	1.17	0.806	1167	12.5	1180	10.138	1203	16.9396	1203	16.94
254.4	434148.7	1.734	9.643323	0.3013	4.20197	1.0793	0.29389	1.04	0.96	1660.9	15.18	1674	8.8527	1691	5.557267	1691	5.557
434	635225.2	4.344	10.08198	0.5096	3.56712	2.2407	0.26083	2.18	0.974	1494.1	29.1	1542	17.772	1609	9.498026	1609	9.498
94.27	124249.9	0.977	12.49148	1.9429	2.23327	2.3653	0.20233	1.35	0.57	1187.8	14.63	1192	16.59	1198	38.33302	1198	38.33
548.5	705790.4	9.479	10.40388	0.6591	3.37587	1.7036	0.25473	1.57	0.922	1462.8	20.56	1499	13.346	1550	12.37902	1550	12.38
49.92	20588.69	1.382	12.05428	3.1826	2.29827	3.3747	0.20093	1.12	0.333	1180.3	12.11	1212	23.882	1268	62.12669	1268	62.13
258.5	492363.3	2.308	9.332689	1.5827	4.72251	2.0398	0.31965	1.29	0.631	1788	20.09	1771	17.094	1751	28.96969	1751	28.97
156.5	40343.98	1.208	19.8557	18.607	0.18116	18.819	0.02609	2.82	0.15	166.02	4.623	169	29.317	212	434.4232	166	4.623
152.9	36089.79	2.3	21.28469	11.401	0.22373	11.533	0.03454	1.74	0.151	218.89	3.742	205	21.413	48	273.0398	219	3.742
71.67	1878.585	1.061	1.691735	439.89	0.31432	441.57	0.00386	38.5	0.087	24.813	9.534	278	#NUM!	NA	NA	25	9.534
13.85	18963.09	1.261	12.596	8.8646	2.30781	9.5216	0.21083	3.48	0.365	1233.2	39.01	1215	67.552	1182	175.5476	1182	175.5
133	164071.4	1.504	12.46974	1.6106	2.30057	2.1838	0.20806	1.47	0.675	1218.5	16.37	1212	15.457	1202	31.76219	1202	31.76
840.8	134185.1	6.151	19.61538	1.6831	0.25486	1.7803	0.03626	0.58	0.326	229.59	1.308	231	3.6714	240	38.81405	230	1.308
562.5	447600.2	3.05	10.44303	0.5202	3.49247	1.1246	0.26452	1	0.887	1512.9	13.44	1526	8.8772	1543	9.780073	1543	9.78
109.5	13554.48	1.335	21.93807	16.226	0.2228	16.315	0.03545	1.7	0.104	224.57	3.761	204	30.193	-24	395.1005	225	3.761
223.7	40413.41	2.355	20.30714	3.4009	0.22738	4.6265	0.03349	3.14	0.678	212.35	6.552	208	8.7029	159	79.59589	212	6.552

223.7	40413.41	2.355	20.30714	3.4009	0.22738	4.6265	0.03349	3.14	0.678	212.35	6.552	208.033	8.7029	159.477	79.59589	212.346	6.552
22.58	17386.86	1.468	12.58328	6.7778	2.19512	7.0755	0.20033	2.03	0.287	1177.1	21.85	1179	49.397	1184	134.0586	1184	134.1
24.47	20702.13	0.772	12.23844	5.5862	2.21797	5.7826	0.19687	1.49	0.258	1158.5	15.84	1187	40.491	1239	109.5799	1239	109.6
178.9	446493	1.58	9.721548	0.6013	4.08686	1.0467	0.28815	0.86	0.819	1632.3	12.35	1652	8.5391	1676	11.11193	1676	11.11
163	23939.7	2.354	20.18001	7.2323	0.23048	7.3594	0.03373	1.36	0.185	213.87	2.865	211	13.998	174	168.926	214	2.865
65.81	80621.12	1.055	9.720869	1.29	4.19324	2.2112	0.29563	1.8	0.812	1669.6	26.42	1673	18.131	1677	23.83668	1677	23.84
171.4	261573.9	1.834	9.684086	0.4999	4.28508	2.0553	0.30097	1.99	0.97	1696.1	29.73	1690	16.922	1684	9.229429	1684	9.229
120.6	11585.13	1.131	20.91476	14.027	0.1708	14.348	0.02591	3.02	0.21	164.89	4.913	160	21.257	90	333.8098	165	4.913
29.75	254.6863	0.285	7.010986	16.068	0.74981	18.26	0.03813	8.67	0.475	241.21	20.54	568	79.611	2259	279.2332	241	20.54
96.46	9157.78	15.73	24.26021	12.012	0.18965	12.411	0.03337	3.12	0.252	211.6	6.498	176	20.092	-274	306.3118	212	6.498
149.4	31432.02	2.552	20.22591	10.129	0.23394	10.467	0.03432	2.64	0.252	217.51	5.642	213	20.152	169	237.0668	218	5.642

JFH-11-4M N34.42740 W118.42239

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
79.4	18336.22	1.45	19.38976	6.8428	0.48327	6.9842	0.06796	1.4	0.2	423.86	5.735	400	23.109	267	157.1487	424	5.735
1233	809474.7	1.718	10.08437	0.31	3.69476	1.682	0.27023	1.65	0.983	1542	22.67	1570	13.441	1608	5.778904	1608	5.779
111.8	17319.6	1.399	19.39877	12.16	0.23567	12.259	0.03316	1.55	0.127	210.28	3.211	215	23.744	265	279.9275	210	3.211
359.5	74580.38	1.139	20.05035	5.7398	0.22859	5.8754	0.03324	1.26	0.214	210.8	2.603	209	11.1	189	133.6684	211	2.603
864	176007.6	3.177	19.63372	2.0317	0.23962	3.4198	0.03412	2.75	0.804	216.29	5.851	218	6.7123	238	46.86088	216	5.851
1105	262654.1	2.708	19.92294	1.3673	0.23442	1.6448	0.03387	0.91	0.556	214.74	1.931	214	3.1715	204	31.75206	215	1.931
906.2	237079.6	3.136	19.791	1.5346	0.23662	1.6988	0.03396	0.73	0.429	215.31	1.543	216	3.3006	219	35.51629	215	1.543
411.6	50618.68	1.292	19.88997	4.2443	0.23766	4.4506	0.03428	1.34	0.301	217.3	2.862	217	8.6779	208	98.4425	217	2.862
506.8	64423.68	1.671	19.68667	2.8403	0.23886	3.2762	0.03411	1.63	0.498	216.19	3.472	217	6.4141	232	65.60089	216	3.472
60.42	15090.43	1.42	24.42881	50.661	0.19791	50.91	0.03506	5.03	0.099	222.17	10.99	183	85.606	-292	1371.423	222	10.99
213.7	36569.45	1.228	20.82379	7.2545	0.23828	7.3886	0.03599	1.4	0.19	227.91	3.139	217	14.438	100	171.7622	228	3.139
781.8	153219	2.966	19.68459	1.9646	0.24301	4.7712	0.03469	4.35	0.911	219.85	9.398	221	9.4714	232	45.38536	220	9.398
138.9	13916.59	1.448	20.88588	14.925	0.22239	15.128	0.03369	2.47	0.163	213.58	5.195	204	27.953	93	355.1741	214	5.195
335.3	53062.11	2.039	19.53185	4.6509	0.23528	5.0437	0.03333	1.95	0.387	211.35	4.057	215	9.7545	250	107.0841	211	4.057
741.9	165911.1	0.604	19.85279	3.0833	0.239	3.3165	0.03441	1.22	0.368	218.1	2.62	218	6.4959	212	71.45114	218	2.62
135.7	18736.16	2.241	19.52608	8.5393	0.24668	8.9346	0.03493	2.63	0.294	221.36	5.719	224	17.953	250	196.7813	221	5.719
150.6	36269.17	2.198	19.10318	7.3392	0.23747	9.7079	0.0329	6.35	0.655	208.68	13.05	216	18.918	301	167.5776	209	13.05
110	17217.79	2.11	19.44885	8.9166	0.24575	9.714	0.03466	3.85	0.397	219.67	8.325	223	19.46	260	205.1694	220	8.325
86.81	50282.23	1.255	10.12212	1.1176	3.8278	2.2564	0.28101	1.96	0.869	1596.4	27.72	1599	18.167	1601	20.85092	1601	20.85
123.6	19864.65	1.417	19.4924	12.794	0.23931	13.131	0.03383	2.96	0.225	214.49	6.234	218	25.751	254	295.2119	214	6.234
130.7	9623.415	0.984	24.42207	27.313	0.14615	27.468	0.02589	2.91	0.106	164.75	4.74	139	35.579	-291	707.788	165	4.74
702.5	130021.3	1.673	19.55825	1.8402	0.23722	2.0541	0.03365	0.91	0.444	213.35	1.916	216	3.9992	247	42.36609	213	1.916
210.3	43696.34	1.507	20.25803	3.5391	0.24347	6.9912	0.03577	6.03	0.862	226.57	13.42	221	13.9	165	82.7506	227	13.42
120.1	40734.41	3.397	20.67992	13.868	0.22897	14.47	0.03434	4.13	0.285	217.66	8.836	209	27.38	117	328.3714	218	8.836
550.7	75187.71	0.726	20.16642	2.6889	0.23142	2.9389	0.03385	1.19	0.404	214.59	2.503	211	5.6081	176	62.7243	215	2.503
148.9	46860.86	3.841	19.03916	9.8437	0.24639	10.052	0.03402	2.04	0.203	215.68	4.321	224	20.18	308	224.6215	216	4.321
587.1	51120.01	1.431	20.18801	3.1066	0.22903	3.2556	0.03353	0.97	0.299	212.63	2.036	209	6.1602	173	72.51722	213	2.036
76.38	20862.39	1.864	19.81781	17.107	0.22371	18.701	0.03215	7.55	0.404	204.02	15.17	205	34.727	216	398.6244	204	15.17
111.3	17496.1	2.054	20.83997	11.055	0.22594	11.422	0.03415	2.87	0.251	216.47	6.111	207	21.377	99	262.2438	216	6.111
223.5	42506.07	2.44	19.07833	3.5319	0.24454	4.007	0.03384	1.89	0.472	214.51	3.993	222	7.9946	304	80.49674	215	3.993
145.5	41200.84	1.06	20.60689	7.2113	0.22918	7.3214	0.03425	1.27	0.173	217.11	2.701	210	13.862	125	169.9553	217	2.701
107.8	44504.15	1.957	19.93246	17.206	0.24966	17.327	0.03609	2.05	0.118	228.57	4.606	226	35.164	203	401.9041	229	4.606
135.8	23149	8.503	23.36671	10.781	0.20057	11.319	0.03399	3.45	0.305	215.47	7.309	186	19.202	-179	269.6685	215	7.309
105.3	23040.82	1.409	19.14491	13.807	0.24452	14.051	0.03395	2.6	0.185	215.24	5.513	222	28.038	296	316.4375	215	5.513
579	89391.55	1.268	19.59694	4.894	0.18364	5.0484	0.0261	1.24	0.245	166.1	2.031	171	7.953	242	112.843	166	2.031

JFH-11-5M N34.33877 W118.39300

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
68	53421	1.6	12.5901	3.0	2.2135	3.1	0.2021	0.8	0.26	1186.7	8.8	1185	21.8	1183	59.5	1183	59.5
27	10024	1.6	12.8466	7.1	2.1611	7.4	0.2014	2.1	0.28	1182.6	22.8	1169	51.6	1143	141.8	1143	141.8
636	599112	8.3	9.9460	0.8	4.0223	1.5	0.2902	1.3	0.86	1642.3	18.8	1639	12.2	1634	14.3	1634	14.3
786	782002	3.3	9.7269	0.2	3.5878	3.3	0.2531	3.3	1.00	1454.5	43.5	1547	26.6	1675	3.8	1675	3.8
48	29866	1.6	12.4146	3.0	2.2374	3.1	0.2015	0.9	0.27	1183.1	9.2	1193	21.9	1210	59.1	1210	59.1
328	2011	1.8	21.4734	46.5	0.0252	46.7	0.0039	3.7	0.08	25.3	0.9	25	11.7	27	1173.3	25	0.9
135	64343	1.1	10.0208	1.3	4.0489	2.9	0.2943	2.6	0.89	1662.8	38.3	1644	23.9	1620	24.7	1620	24.7
53	27221	1.3	12.4332	2.9	2.2755	3.0	0.2052	0.8	0.27	1203.2	8.9	1205	21.0	1208	56.4	1208	56.4
113	119348	1.3	12.4657	1.2	2.2817	2.3	0.2063	2.0	0.86	1209.0	21.7	1207	16.2	1202	23.0	1202	23.0
98	51924	2.1	12.4962	1.3	2.2185	1.4	0.2011	0.7	0.49	1181.0	7.6	1187	10.1	1198	24.7	1198	24.7
214	150931	1.4	12.3636	0.7	2.2744	0.8	0.2039	0.5	0.62	1196.5	5.7	1204	5.9	1219	13.0	1219	13.0
33	11505	1.7	12.5028	2.9	2.2878	3.1	0.2075	1.1	0.36	1215.2	12.4	1209	22.0	1197	57.2	1197	57.2
38	22889	1.6	12.4469	3.3	2.2900	3.5	0.2067	1.2	0.33	1211.4	12.9	1209	25.0	1205	65.9	1205	65.9
249	187083	1.1	12.3779	0.8	2.2697	1.0	0.2038	0.7	0.68	1195.5	7.8	1203	7.4	1216	15.0	1216	15.0
160	65393	1.0	12.4985	0.6	2.3139	2.5	0.2098	2.4	0.97	1227.5	27.0	1217	17.7	1197	12.7	1197	12.7
52	69879	0.8	12.3206	2.9	2.3114	3.7	0.2065	2.3	0.63	1210.3	25.6	1216	26.1	1225	56.3	1225	56.3
28	10685	1.7	11.9884	4.3	2.3465	4.6	0.2040	1.4	0.31	1196.9	15.4	1226	32.4	1279	84.4	1279	84.4
40	23571	0.8	12.5215	4.3	1.8664	4.6	0.1695	1.6	0.35	1009.3	14.8	1069	30.3	1194	84.9	1194	84.9
96	40579	3.5	12.3462	2.7	2.2949	2.9	0.2055	1.0	0.34	1204.8	10.7	1211	20.3	1221	53.0	1221	53.0
36	18693	1.0	12.4629	3.4	2.2712	3.5	0.2053	1.1	0.30	1203.7	11.7	1203	24.8	1203	66.2	1203	66.2
53	16074	1.0	12.6464	2.5	2.2184	2.6	0.2035	0.9	0.34	1193.9	9.7	1187	18.3	1174	48.5	1174	48.5
45	41668	1.4	12.2434	2.9	2.3128	3.1	0.2054	1.2	0.38	1204.1	13.2	1216	22.3	1238	57.0	1238	57.0
255	181494	1.3	12.4728	0.7	2.2486	0.9	0.2034	0.6	0.65	1193.6	6.7	1196	6.6	1201	14.0	1201	14.0
47	30811	1.7	12.3533	3.2	2.2377	3.2	0.2005	0.8	0.24	1177.9	8.4	1193	22.8	1220	62.0	1220	62.0
27	13126	1.1	12.4450	3.6	2.2582	4.0	0.2038	1.6	0.40	1195.9	17.5	1199	27.9	1206	71.4	1206	71.4
301	1568	2.3	18.4429	24.8	0.0288	26.3	0.0038	8.7	0.33	24.7	2.2	29	7.5	380	564.9	25	2.2
262	367838	0.6	11.2118	0.6	3.0558	1.1	0.2485	0.9	0.83	1430.7	11.2	1422	8.0	1408	11.3	1408	11.3
424	109966	1.8	12.4132	0.4	2.2671	0.6	0.2041	0.4	0.77	1197.4	4.8	1202	4.0	1211	7.3	1211	7.3
67	27313	1.7	12.7332	1.9	2.2075	2.3	0.2039	1.3	0.58	1196.0	14.6	1183	16.2	1160	37.5	1160	37.5

JFH-11-6M N34.46488 W118.37210

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
279.4	35853.88	0.885	18.23057	2.389	0.51771	2.7537	0.06845	1.37	0.497	426.82	5.656	424	9.5381	406	53.48024	427	5.656
646	11061.41	0.939	21.17418	43.07	0.02585	43.476	0.00397	5.93	0.136	25.54	1.511	26	11.124	61	1071.311	26	1.511
385.9	34410.86	1.339	20.37566	7.143	0.17805	7.4778	0.02631	2.21	0.296	167.43	3.657	166	11.477	152	167.5402	167	3.657
271.7	72399.66	1.125	12.47516	0.8235	2.27917	1.1375	0.20622	0.78	0.69	1208.6	8.649	1206	8.0281	1201	16.23155	1201	16.23
218.5	2978.837	1.861	20.79507	69.452	0.02688	70.402	0.00405	11.5	0.164	26.079	3	27	18.713	104	1880.55	26	3
38.88	22629.06	1.825	12.74353	3.7852	2.19567	5.5749	0.20293	4.09	0.734	1191.1	44.51	1180	38.912	1159	75.09401	1159	75.09
299	5748.114	1.256	21.769	70.436	0.02466	70.79	0.00389	7.07	0.1	25.05	1.769	25	17.301	-6	1953.524	25	1.769
324.5	190884.8	2.877	10.58909	1.411	2.47599	2.1793	0.19015	1.66	0.762	1122.2	17.11	1265	15.764	1517	26.61919	1517	26.62
81.77	37182.25	1.432	12.39679	2.1189	2.24178	2.2937	0.20156	0.88	0.383	1183.7	9.496	1194	16.107	1213	41.67884	1213	41.68
48.85	61669.01	1.808	12.33684	3.9164	2.32586	7.988	0.20811	6.96	0.872	1218.7	77.31	1220	56.781	1223	76.97312	1223	76.97
990.5	7376.087	2.036	22.12704	18.818	0.02393	19.465	0.00384	4.98	0.256	24.704	1.228	24	4.6183	-45	460.933	25	1.228
197.2	15883.68	1.935	19.84157	7.884	0.21528	7.9794	0.03098	1.23	0.154	196.68	2.383	198	14.354	213	182.8782	197	2.383
68.6	47404.41	1.023	12.57212	2.4141	2.17252	2.5188	0.19809	0.72	0.285	1165.1	7.66	1172	17.516	1186	47.69696	1186	47.7
462.8	640309.2	2.607	9.299812	0.2475	4.79808	3.7073	0.32362	3.7	0.998	1807.4	58.3	1785	31.161	1758	4.527166	1758	4.527
101.7	8378.631	0.934	25.14946	16.592	0.14355	17.077	0.02618	4.04	0.237	166.62	6.653	136	21.77	-366	432.1607	167	6.653

200.1	2295.247	2.054	34.81309	71.946	0.01586	72.893	0.004	11.7	0.161	25.762	3.01	16	11.555	-1294	833.9531	26	3.01
191.6	1397.603	2.052	15.80288	117.92	0.03612	118.96	0.00414	15.7	0.132	26.631	4.172	36	42.133	718	630.1147	27	4.172
666.8	33758.75	1.237	23.77907	40.969	0.02225	41.337	0.00384	5.5	0.133	24.692	1.356	22	9.1369	-223	1070.255	25	1.356
237.1	1902.64	2.624	19.89957	36.166	0.02608	39.883	0.00376	16.8	0.422	24.223	4.065	26	10.295	207	864.2983	24	4.065
132.9	1300.976	1.589	8.479853	186.95	0.06957	187.3	0.00428	11.4	0.061	27.524	3.119	68	124.32	1925	140.814	28	3.119
53.54	44207.1	2.062	12.64021	3.1453	2.20138	3.3437	0.20181	1.13	0.339	1185	12.29	1181	23.351	1175	62.26339	1175	62.26
163.1	1363.913	2.018	-5.359751	442.56	-0.1027	442.95	0.00399	18.5	0.042	25.681	4.744	-110	-567.1	NA	NA	26	4.744
50.23	22071.34	1.001	12.28419	2.5743	2.27569	2.8265	0.20275	1.17	0.413	1190.1	12.68	1205	19.941	1231	50.51057	1231	50.51
579.1	8708.894	2.056	31.17551	40.71	0.01744	40.834	0.00394	3.18	0.078	25.372	0.806	18	7.1078	-958	1236.984	25	0.806
279.5	22408.55	1.906	19.58622	4.8424	0.22296	5.2061	0.03167	1.91	0.367	201	3.783	204	9.6375	243	111.6253	201	3.783
131.2	51886.1	1.113	12.38116	1.4914	2.27225	2.0302	0.20404	1.38	0.679	1197	15.05	1204	14.316	1216	29.31664	1216	29.32
282.9	278154.6	1.3	9.300177	0.3943	4.73672	1.0551	0.3195	0.98	0.928	1787.3	15.28	1774	8.8458	1758	7.211217	1758	7.211
111.1	48270.46	1.226	12.3667	1.761	2.28414	2.0478	0.20487	1.05	0.51	1201.4	11.46	1207	14.462	1218	34.60918	1218	34.61
490.7	138419.9	1.069	9.822936	0.3952	3.90094	1.6765	0.27791	1.63	0.972	1580.8	22.84	1614	13.55	1657	7.317891	1657	7.318
453.1	5385.356	1.208	34.47631	48.939	0.0157	49.252	0.00393	5.54	0.113	25.262	1.397	16	7.7318	NA	NA	25	1.397
72	41969.2	1.381	12.39797	2.8159	2.27434	2.9264	0.20451	0.8	0.272	1199.5	8.719	1204	20.642	1213	55.43473	1213	55.43
211.5	2523.196	1.308	21.21171	89.37	0.0265	89.839	0.00408	9.17	0.102	26.224	2.401	27	23.551	57	2918.612	26	2.401
146.6	1573.052	1.742	-14.9795	156.43	-0.037	156.94	0.00402	12.7	0.081	25.833	3.264	-38	-61.23	NA	NA	26	3.264
193.9	1562.185	1.618	13.88796	95.54	0.03803	96.057	0.00383	9.95	0.104	24.645	2.448	38	35.747	986	284.7054	25	2.448
16.6	12134.35	1.863	11.82146	8.0487	2.33057	8.377	0.19982	2.32	0.277	1174.3	24.93	1222	59.588	1306	156.5292	1306	156.5
162.9	1129.699	1.65	30.65722	118.46	0.0174	119.03	0.00387	11.6	0.098	24.893	2.886	18	20.674	-909	0	25	2.886
111	83377.68	1.273	12.41241	2.4763	2.29617	2.7071	0.20671	1.09	0.404	1211.3	12.08	1211	19.151	1211	48.74816	1211	48.75
176.5	2277.358	1.695	13.37582	78.213	0.04105	78.779	0.00398	9.42	0.12	25.623	2.41	41	31.555	1062	1953.154	26	2.41
123.6	17205.73	1.456	18.39127	3.5038	0.50395	3.6624	0.06722	1.07	0.291	419.38	4.328	414	12.461	387	78.70206	419	4.328

JFH-11-7M N34.48093 W118.37843

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
111	16576	1.7	19.1349	8.2	0.4906	8.3	0.0681	1.1	0.14	424.6	4.7	405	27.8	297	188.3	425	4.7
251	2769	1.3	21.3382	55.7	0.0270	57.1	0.0042	12.4	0.22	26.9	3.3	27	15.2	42	1439.1	27	3.3
336	1577	1.5	25.5746	41.1	0.0198	42.4	0.0037	10.7	0.25	23.6	2.5	20	8.4	-410	1113.3	24	2.5
397	330	1.3	22.3440	40.0	0.0235	40.5	0.0038	6.2	0.15	24.5	1.5	24	9.4	-69	1012.8	24	1.5
548	8079	1.3	25.9815	29.7	0.0207	29.8	0.0039	3.1	0.10	25.1	0.8	21	6.1	-451	796.3	25	0.8
267	247801	1.9	9.5566	0.2	4.3850	1.8	0.3039	1.8	0.99	1710.7	27.1	1710	15.0	1708	3.9	1708	3.9
686	2887	1.3	24.4696	12.9	0.0228	13.7	0.0040	4.6	0.33	26.0	1.2	23	3.1	-296	330.5	26	1.2
1450	8789	1.6	20.8259	11.4	0.0265	11.5	0.0040	1.6	0.14	25.7	0.4	27	3.0	100	270.4	26	0.4
116	11525	1.1	25.7061	20.4	0.1375	20.6	0.0256	3.2	0.15	163.2	5.1	131	25.3	-423	538.0	163	5.1
777	637206	1.9	9.6823	0.7	4.3828	0.9	0.3078	0.7	0.71	1729.7	10.0	1709	7.7	1684	12.1	1684	12.1
26	17975	1.4	12.4031	8.2	2.3251	8.8	0.2092	3.3	0.38	1224.3	37.4	1220	62.7	1212	160.9	1212	160.9
196	2788	1.3	21.2788	65.1	0.0281	67.5	0.0043	18.0	0.27	27.9	5.0	28	18.7	49	1741.7	28	5.0
380	4221	2.3	19.6013	22.7	0.0288	24.4	0.0041	8.8	0.36	26.3	2.3	29	6.9	242	529.5	26	2.3
367	2009	1.2	19.1624	24.4	0.0299	24.8	0.0042	4.6	0.19	26.8	1.2	30	7.3	294	563.9	27	1.2
221	162926	1.7	9.5286	0.3	4.5223	2.1	0.3125	2.0	0.99	1753.1	31.3	1735	17.1	1713	4.7	1713	4.7
363	24106	1.8	20.3350	6.0	0.1759	6.2	0.0259	1.7	0.28	165.1	2.8	165	9.4	156	139.8	165	2.8
293	176495	3.1	9.9826	1.9	3.8080	2.9	0.2757	2.2	0.76	1569.7	30.7	1594	23.4	1627	35.2	1627	35.2
204	180565	1.9	9.2949	0.4	4.6525	1.0	0.3136	1.0	0.93	1758.6	15.0	1759	8.8	1759	7.0	1759	7.0
650	247070	1.5	11.1640	0.4	2.8753	1.8	0.2328	1.7	0.98	1349.2	20.9	1375	13.2	1416	7.3	1416	7.3
430	5314	2.3	22.5250	30.6	0.0242	30.8	0.0040	3.1	0.10	25.5	0.8	24	7.4	-89	766.3	25	0.8
299	151011	4.7	10.4888	1.7	3.1921	5.7	0.2428	5.4	0.95	1401.4	68.3	1455	44.0	1535	32.1	1535	32.1
339	383581	4.8	9.5564	0.4	4.4034	2.4	0.3052	2.4	0.98	1717.0	36.3	1713	20.2	1708	7.9	1708	7.9
855	27911	5.9	22.5285	14.8	0.0692	21.7	0.0113	15.9	0.73	72.4	11.4	68	14.3	-89	365.7	72	11.4

191	1346	2.1	14.4708	176.7	0.0363	177.5	0.0038	16.6	0.09	24.5	4.1	36	63.2	902	881.1	25	4.1
1218	20049	1.2	22.0093	19.9	0.0250	20.5	0.0040	4.9	0.24	25.7	1.2	25	5.1	-32	485.9	26	1.2
180	113111	2.0	9.3964	0.5	4.4780	1.0	0.3052	0.9	0.88	1716.9	13.3	1727	8.3	1739	8.7	1739	8.7
214	171895	0.8	9.3280	0.4	4.4887	0.9	0.3037	0.8	0.89	1709.5	12.2	1729	7.6	1752	7.7	1752	7.7
2315	351675	9.0	9.3858	0.2	4.5674	1.0	0.3109	1.0	0.98	1745.2	15.0	1743	8.3	1741	3.3	1741	3.3
187	131713	3.4	10.3343	0.5	3.6806	3.1	0.2759	3.1	0.99	1570.5	42.9	1567	24.9	1563	9.2	1563	9.2
532	9761	1.2	22.2775	19.3	0.0235	20.1	0.0038	5.3	0.26	24.4	1.3	24	4.7	-62	475.6	24	1.3
65	40619	1.2	12.3908	1.8	2.2039	2.2	0.1981	1.3	0.57	1164.9	13.4	1182	15.3	1214	35.4	1214	35.4
456	784708	40.9	11.2391	0.5	2.6046	2.2	0.2123	2.2	0.98	1241.1	24.6	1302	16.3	1404	8.9	1404	8.9
593	313021	1.2	9.6287	0.2	4.1088	1.0	0.2869	1.0	0.98	1626.2	14.2	1656	8.2	1694	3.8	1694	3.8
539	213172	2.1	9.8616	0.3	3.6586	0.8	0.2617	0.7	0.92	1498.4	9.2	1562	6.0	1650	5.5	1650	5.5
196	209177	2.5	9.5313	0.5	4.4460	1.4	0.3073	1.3	0.94	1727.6	20.2	1721	11.7	1713	8.7	1713	8.7
483	1473	1.9	-0.5309	3233.7	-1.0229	3233.7	0.0039	7.6	0.00	25.3	1.9	#NUM!	#NUM!	NA	NA	25	1.9
884	18468	2.0	19.5875	12.8	0.0270	14.0	0.0038	5.7	0.41	24.7	1.4	27	3.8	243	296.2	25	1.4
346	16115	0.6	20.6595	6.7	0.1713	6.7	0.0257	0.8	0.13	163.4	1.4	161	10.0	119	157.2	163	1.4
270	32952	1.8	19.7736	5.8	0.2155	5.9	0.0309	1.1	0.19	196.2	2.1	198	10.6	221	134.1	196	2.1
27	20302	1.1	12.7697	4.9	2.1179	5.1	0.1962	1.4	0.28	1154.6	15.1	1155	35.4	1155	97.7	1155	97.7
169	16301	1.6	20.8812	8.9	0.2061	9.2	0.0312	2.1	0.23	198.2	4.2	190	15.9	94	211.8	198	4.2
3159	36376	0.5	21.2200	4.8	0.0261	5.0	0.0040	1.2	0.25	25.8	0.3	26	1.3	56	114.5	26	0.3
358	36954	1.0	20.4205	7.1	0.1778	7.3	0.0263	1.6	0.22	167.5	2.6	166	11.2	146	166.8	168	2.6
156	1998	2.8	24.6605	75.6	0.0227	78.0	0.0041	19.4	0.25	26.1	5.1	23	17.6	-316	2283.5	26	5.1
300	1950	2.0	18.9429	21.5	0.0324	22.4	0.0045	6.3	0.28	28.6	1.8	32	7.1	320	494.3	29	1.8
223	16773	0.7	20.7731	7.1	0.2384	7.4	0.0359	1.9	0.26	227.5	4.3	217	14.4	106	168.0	227	4.3
1683	18322	1.5	21.4677	9.6	0.0248	9.7	0.0039	1.8	0.19	24.8	0.4	25	2.4	28	229.5	25	0.4
268	4364	2.4	18.8219	67.0	0.0293	67.5	0.0040	8.6	0.13	25.7	2.2	29	19.5	334	1723.0	26	2.2
391	23634	1.3	20.1614	5.1	0.2128	5.1	0.0311	0.7	0.13	197.5	1.3	196	9.2	176	118.9	198	1.3
770	310734	11.0	10.5701	0.7	3.1450	1.4	0.2411	1.2	0.87	1392.4	15.2	1444	10.7	1520	12.7	1520	12.7
160	1505	1.9	14.5085	78.6	0.0351	79.4	0.0037	11.2	0.14	23.7	2.7	35	27.3	897	2010.7	24	2.7
111	36571	1.7	12.5351	1.9	2.2127	2.3	0.2012	1.3	0.58	1181.6	14.5	1185	16.1	1191	37.0	1191	37.0
342	5477	2.2	17.9561	22.4	0.0300	23.2	0.0039	5.9	0.25	25.1	1.5	30	6.8	440	504.9	25	1.5
1038	12297	1.1	21.4743	17.7	0.0250	18.2	0.0039	4.3	0.23	25.0	1.1	25	4.5	27	427.2	25	1.1
78	19955	2.2	17.2620	8.7	0.5353	8.9	0.0670	1.9	0.21	418.2	7.8	435	31.6	527	191.4	418	7.8

JFH-11-8M N34.44432 W118.41926

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
108	19938	1.5	18.5612	5.9	0.4975	6.1	0.0670	1.6	0.26	417.9	6.4	410	20.6	366	132.9	418	6.4
42	24469	1.1	12.6483	4.4	2.2036	4.5	0.2021	0.6	0.13	1186.8	6.5	1182	31.4	1174	88.1	1174	88.1
134	14832	3.0	18.7072	8.6	0.2483	8.9	0.0337	2.1	0.23	213.6	4.4	225	18.0	348	195.9	214	4.4
1183	72123	1.3	20.0611	1.9	0.1706	2.0	0.0248	0.7	0.35	158.1	1.1	160	3.0	188	44.5	158	1.1
77	10877	1.4	19.0821	28.4	0.2475	28.6	0.0343	2.8	0.10	217.2	6.0	225	57.6	303	659.6	217	6.0
84	9882	3.7	22.3768	18.0	0.1914	18.4	0.0311	3.6	0.20	197.2	7.0	178	30.0	-73	442.9	197	7.0
164	24265	3.0	19.5869	11.4	0.2436	11.5	0.0346	1.9	0.16	219.3	4.0	221	22.9	243	262.7	219	4.0
710	57203	2.3	19.9377	2.4	0.2390	3.0	0.0346	1.7	0.58	219.0	3.8	218	5.9	202	56.7	219	3.8
168	2409	3.0	16.1122	65.7	0.0331	67.4	0.0039	15.2	0.23	24.9	3.8	33	21.9	676	1591.4	25	3.8
408	42427	1.4	20.1127	2.8	0.2308	3.0	0.0337	1.2	0.39	213.4	2.5	211	5.8	182	64.8	213	2.5
314	3649	1.4	19.1575	64.3	0.0269	64.7	0.0037	7.7	0.12	24.0	1.8	27	17.2	294	1643.5	24	1.8
310	15885	4.5	19.8151	7.0	0.2291	7.1	0.0329	1.5	0.21	208.8	3.0	209	13.5	217	161.6	209	3.0
545	167961	1.3	10.0182	0.5	3.6593	0.7	0.2659	0.5	0.73	1519.8	7.4	1563	6.0	1621	9.4	1621	9.4
146	64431	1.4	12.4931	0.8	2.2205	1.9	0.2012	1.7	0.90	1181.7	18.6	1188	13.3	1198	16.1	1198	16.1
331	41416	2.5	19.6172	3.1	0.2394	3.2	0.0341	0.8	0.26	215.9	1.8	218	6.3	240	72.0	216	1.8

353	33293	1.7	19.5469	2.6	0.2456	3.5	0.0348	2.3	0.66	220.6	5.0	223	7.0	248	60.0	221	5.0
212	12030	0.8	19.8857	7.2	0.1841	7.4	0.0266	1.7	0.23	169.0	2.8	172	11.7	208	166.6	169	2.8
192	28971	3.4	20.1391	8.0	0.2309	8.9	0.0337	4.0	0.45	213.8	8.4	211	17.0	179	186.5	214	8.4
50	36318	0.8	11.4750	3.5	2.7282	4.7	0.2271	3.1	0.67	1319.1	37.3	1336	34.9	1364	67.4	1364	67.4
137	17853	1.4	19.5168	9.9	0.2420	10.2	0.0342	2.6	0.26	217.1	5.6	220	20.2	252	227.4	217	5.6
38	16172	1.0	12.4051	5.8	2.0051	6.1	0.1804	1.7	0.28	1069.1	16.5	1117	41.0	1212	114.6	1212	114.6
102	9919	1.2	19.3117	16.7	0.2461	17.0	0.0345	2.8	0.17	218.4	6.0	223	34.0	276	385.6	218	6.0
89	6080	27.1	22.3050	20.9	0.1994	21.5	0.0323	5.2	0.24	204.6	10.6	185	36.3	-65	513.8	205	10.6
291	2732	3.4	32.2537	132.1	0.0166	132.3	0.0039	7.3	0.05	24.9	1.8	17	21.9	-1059	0.0	25	1.8
154	10336	1.5	22.2157	11.1	0.2206	11.2	0.0355	1.8	0.16	225.2	4.0	202	20.5	-55	269.9	225	4.0
94	54133	1.8	12.4546	2.0	2.2792	3.2	0.2059	2.4	0.77	1206.8	26.8	1206	22.3	1204	39.7	1204	39.7
131	9110	2.0	19.3105	14.2	0.2452	14.3	0.0343	1.8	0.13	217.6	3.9	223	28.6	276	325.8	218	3.9
83	10335	1.6	20.6675	15.8	0.2321	15.9	0.0348	2.2	0.14	220.5	4.7	212	30.5	118	374.4	220	4.7
33	15044	2.1	12.0315	6.1	2.3565	6.6	0.2056	2.5	0.38	1205.5	27.3	1230	47.0	1272	119.2	1272	119.2
629	95832	0.5	19.8598	2.7	0.2280	2.9	0.0328	0.9	0.32	208.3	1.8	209	5.4	211	62.8	208	1.8
1269	553228	4.1	9.8860	0.4	4.0908	1.1	0.2933	1.0	0.94	1658.0	14.6	1652	8.6	1645	6.6	1645	6.6
544	46525	3.3	19.8111	1.9	0.2335	2.0	0.0336	0.5	0.24	212.7	1.0	213	3.8	217	44.9	213	1.0
153	15121	2.4	21.0412	9.1	0.2269	9.3	0.0346	1.9	0.21	219.4	4.1	208	17.5	76	216.7	219	4.1
208	162169	2.1	11.5793	0.5	2.6673	1.1	0.2240	1.0	0.87	1303.0	11.3	1319	8.1	1346	10.3	1346	10.3
41	22703	1.7	12.5683	2.4	2.2267	2.6	0.2030	1.0	0.40	1191.3	11.4	1189	18.4	1186	47.4	1186	47.4
601	533905	2.9	9.8501	0.4	3.8932	1.1	0.2781	1.0	0.93	1581.9	14.1	1612	8.7	1652	7.4	1652	7.4
606	41474	3.2	19.9325	2.1	0.2464	2.5	0.0356	1.4	0.57	225.6	3.2	224	5.1	203	47.9	226	3.2
186	28625	2.3	19.8389	7.5	0.2440	7.7	0.0351	1.8	0.24	222.5	4.0	222	15.3	214	173.4	222	4.0
85	8519	2.4	23.5860	14.7	0.2082	14.9	0.0356	2.7	0.18	225.6	5.9	192	26.1	-203	369.4	226	5.9
940	684543	3.9	9.7610	0.3	4.0558	0.7	0.2871	0.6	0.90	1627.1	8.5	1645	5.4	1669	5.4	1669	5.4
1069	425636	5.6	9.9015	0.4	4.0129	1.1	0.2882	1.0	0.94	1632.4	14.7	1637	8.8	1642	7.1	1642	7.1
198	17489	2.3	21.1764	7.0	0.2246	7.1	0.0345	1.0	0.14	218.6	2.1	206	13.2	60	167.6	219	2.1
123	2575	1.9	7.6035	177.0	0.0751	178.0	0.0041	19.2	0.11	26.6	5.1	73	126.9	2118	36.8	27	5.1
60	28281	0.9	12.7732	2.9	2.1372	3.4	0.1980	1.7	0.51	1164.5	18.1	1161	23.3	1154	57.6	1154	57.6
62	20989	1.3	12.6237	2.2	2.1999	2.3	0.2014	0.8	0.36	1182.9	9.1	1181	16.4	1178	43.3	1178	43.3
294	24135	1.9	20.2949	4.1	0.2120	4.3	0.0312	1.3	0.30	198.1	2.5	195	7.6	161	95.1	198	2.5
1159	456116	7.0	11.3865	0.3	2.8344	0.9	0.2341	0.8	0.94	1355.8	9.8	1365	6.4	1379	5.6	1379	5.6
855	69005	2.3	20.0134	2.7	0.2322	2.9	0.0337	1.1	0.38	213.7	2.3	212	5.5	193	62.3	214	2.3
207	176663	1.2	10.7707	0.6	3.2244	1.1	0.2519	1.0	0.86	1448.1	12.3	1463	8.5	1485	10.6	1485	10.6
84	50623	2.4	12.4253	2.2	2.1955	2.2	0.1979	0.6	0.25	1163.8	6.0	1180	15.5	1209	42.4	1209	42.4
120	9944	4.3	22.8732	19.9	0.1963	20.0	0.0326	2.8	0.14	206.6	5.7	182	33.4	-126	494.3	207	5.7
123	9561	1.6	22.6619	19.7	0.1587	20.0	0.0261	3.1	0.15	166.0	5.0	150	27.8	-104	488.8	166	5.0
179	213483	2.6	9.8313	0.8	3.9337	1.6	0.2805	1.4	0.86	1593.8	19.8	1621	13.3	1656	15.6	1656	15.6
335	20533	1.0	19.9247	4.8	0.2350	5.1	0.0340	1.8	0.36	215.3	3.8	214	9.8	204	110.4	215	3.8
71	29856	1.9	11.5082	1.9	2.4546	8.3	0.2049	8.0	0.97	1201.5	88.1	1259	59.6	1358	36.4	1358	36.4
212	36360	2.5	20.6300	6.9	0.2256	7.1	0.0338	1.5	0.21	214.0	3.2	207	13.3	122	163.8	214	3.2
37	22545	1.3	11.8955	5.0	2.3032	5.2	0.1987	1.4	0.27	1168.4	14.8	1213	36.7	1294	97.3	1294	97.3
131	8303	1.7	20.8800	13.6	0.2262	13.8	0.0343	2.4	0.18	217.1	5.2	207	25.9	94	323.7	217	5.2
159	129027	1.4	9.6377	0.6	4.2916	1.1	0.3000	0.9	0.81	1691.2	13.0	1692	8.9	1692	11.7	1692	11.7
775	83893	1.3	20.0406	2.5	0.1776	2.5	0.0258	0.4	0.17	164.3	0.7	166	3.8	190	57.6	164	0.7
56	54667	1.9	12.5749	1.9	2.1792	2.2	0.1987	1.0	0.45	1168.6	10.4	1174	15.1	1185	38.2	1185	38.2
165	27398	1.4	18.3744	4.4	0.5099	4.7	0.0679	1.7	0.37	423.8	7.1	418	16.2	389	98.8	424	7.1

JFH-11-9M N34.47161 W118.43510

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)

41	8909	2.4	16.8585	12.2	0.5358	12.7	0.0655	3.5	0.28	409.1	13.9	436	45.2	579	266.9	409	13.9
120	48778	0.9	12.4985	1.3	2.2347	2.3	0.2026	1.9	0.82	1189.1	20.7	1192	16.2	1197	26.0	1197	26.0
24	31674	2.6	12.2973	3.3	2.2694	4.4	0.2024	2.9	0.65	1188.2	30.9	1203	30.8	1229	65.0	1229	65.0
660	3165	1.7	23.3148	15.2	0.0233	15.9	0.0039	4.6	0.29	25.3	1.2	23	3.7	-174	379.7	25	1.2
345	100659	5.4	10.9786	0.4	2.9911	3.0	0.2382	3.0	0.99	1377.1	37.2	1405	23.0	1448	7.3	1448	7.3
122	12776	0.7	11.9221	3.6	2.3010	4.1	0.1990	1.9	0.48	1169.7	20.8	1213	28.8	1290	69.7	1290	69.7
33	11904	1.0	12.7128	5.6	2.1932	5.7	0.2022	1.5	0.26	1187.2	15.9	1179	40.1	1164	110.2	1164	110.2
827	5213	1.0	19.4683	14.3	0.0278	15.8	0.0039	6.6	0.42	25.3	1.7	28	4.3	257	330.2	25	1.7
22	12403	1.5	12.5552	7.0	2.1712	7.2	0.1977	1.7	0.24	1163.0	18.5	1172	50.4	1188	139.1	1188	139.1
366	274587	0.6	11.1084	0.5	3.0439	1.4	0.2452	1.4	0.95	1413.9	17.4	1419	11.0	1426	8.8	1426	8.8
570	6189	1.4	29.5681	47.0	0.0181	47.3	0.0039	5.5	0.12	25.0	1.4	18	8.5	-805	1399.4	25	1.4
374	159567	4.7	10.4323	0.6	3.4535	1.7	0.2613	1.5	0.93	1496.5	20.4	1517	13.0	1545	11.8	1545	11.8
161	66067	1.0	12.3556	1.1	2.2703	1.5	0.2034	1.0	0.67	1193.8	11.3	1203	10.9	1220	22.4	1220	22.4
75	33645	1.2	12.4379	1.5	2.2366	1.8	0.2018	1.0	0.57	1184.7	11.1	1193	12.6	1207	29.1	1207	29.1
402	5162	1.5	23.2825	29.9	0.0229	31.4	0.0039	9.4	0.30	24.9	2.3	23	7.1	-170	759.7	25	2.3
785	5256	1.7	26.3363	24.1	0.0206	24.5	0.0039	4.5	0.19	25.3	1.1	21	5.0	-487	646.8	25	1.1
27	12479	0.9	12.6498	3.3	2.2102	3.6	0.2028	1.4	0.39	1190.2	15.3	1184	25.4	1173	66.3	1173	66.3
94	54812	2.0	12.3888	1.8	2.2200	2.7	0.1995	2.1	0.76	1172.5	22.1	1187	19.1	1215	35.1	1215	35.1
17	74	1.9	561.8855	1360.3	0.0067	1360.4	0.0268	19.9	0.01	170.3	33.4	7	92.9	0	0.0	179	33.4
106	44720	2.0	12.2223	1.4	2.2839	2.5	0.2025	2.1	0.84	1188.5	23.2	1207	17.9	1241	26.8	1241	26.8
287	17437	0.9	22.4570	9.1	0.1434	9.2	0.0234	1.7	0.19	148.8	2.5	136	11.7	-81	222.0	149	2.5
21	10740	1.1	12.6683	8.6	2.1836	8.8	0.2006	1.6	0.19	1178.7	17.7	1176	61.1	1171	170.6	1171	170.6
124	1309	2.0	-2.9950	510.5	-0.1695	510.8	0.0037	17.7	0.03	23.7	4.2	-189	#NUM!	NA	NA	24	4.2
339	152396	2.7	9.5693	0.2	4.2581	0.8	0.2955	0.8	0.96	1669.1	11.5	1685	6.7	1706	4.2	1706	4.2
167	13539	2.1	20.9678	6.5	0.2294	7.2	0.0349	3.1	0.44	221.0	6.8	210	13.6	84	153.6	221	6.8
97	93850	0.9	12.4635	1.3	2.2260	1.7	0.2012	1.0	0.59	1181.8	10.5	1189	11.6	1203	26.3	1203	26.3
557	447083	1.6	9.3626	0.2	4.5805	2.4	0.3110	2.4	1.00	1745.8	36.2	1746	19.8	1746	4.3	1746	4.3
429	1488	1.7	21.5637	35.4	0.0250	36.2	0.0039	7.6	0.21	25.2	1.9	25	9.0	17	875.1	25	1.9
176	41513	2.1	12.2881	1.1	2.2603	1.3	0.2014	0.8	0.58	1183.1	8.3	1200	9.3	1231	21.2	1231	21.2
105	101343	0.9	9.6844	0.9	4.1898	1.1	0.2943	0.6	0.56	1662.9	8.8	1672	8.8	1683	16.4	1683	16.4
189	95416	1.2	12.3999	0.7	2.2092	1.0	0.1987	0.7	0.69	1168.2	7.6	1184	7.2	1213	14.7	1213	14.7
221	434317	2.5	9.9428	0.5	3.8514	1.7	0.2777	1.6	0.96	1579.9	22.6	1604	13.6	1635	9.2	1635	9.2
239	265085	2.5	9.5289	0.2	4.1751	2.9	0.2885	2.9	1.00	1634.3	41.4	1669	23.6	1713	4.2	1713	4.2
56	19260	1.4	12.4315	2.7	2.2179	3.0	0.2000	1.3	0.43	1175.2	13.8	1187	20.9	1208	53.2	1208	53.2
144	965	2.5	2.3153	567.9	0.2198	568.1	0.0037	16.2	0.03	23.8	3.8	202	#NUM!	4024	381.7	24	3.8
291	45656	1.1	18.1926	2.7	0.5019	3.1	0.0662	1.5	0.47	413.4	5.8	413	10.6	411	61.4	413	5.8

JFH-11-10M N34.49412 W118.45848

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
184	13315	0.8	21.2803	10.9	0.1551	11.8	0.0239	4.4	0.38	152.5	6.7	146	16.0	49	260.7	152	6.7
293	14119	1.8	20.4213	14.6	0.0890	14.7	0.0132	1.8	0.12	84.4	1.5	87	12.2	146	343.3	84	1.5
94	5951	1.6	18.6299	12.2	0.3013	12.3	0.0407	2.0	0.16	257.2	5.1	267	29.0	358	275.4	257	5.1
180	124031	2.3	9.7154	0.6	4.2141	1.4	0.2969	1.3	0.92	1676.1	19.6	1677	11.9	1678	10.4	1678	10.4
100	25003	2.0	9.8794	0.5	4.2336	5.5	0.3033	5.4	1.00	1707.9	81.8	1681	45.0	1647	9.9	1647	9.9
50	41591	1.8	12.5159	2.9	2.2123	3.1	0.2008	1.0	0.32	1179.7	10.5	1185	21.7	1194	58.0	1194	58.0
567	17722	0.7	22.8423	8.5	0.0828	8.6	0.0137	1.2	0.14	87.8	1.1	81	6.7	-123	209.8	88	1.1
594	25076	1.4	21.6981	4.6	0.0867	5.0	0.0136	2.0	0.41	87.3	1.8	84	4.0	2	109.9	87	1.8
106	3363	1.6	29.3574	48.5	0.0615	48.8	0.0131	5.6	0.12	83.9	4.7	61	28.7	-785	1441.5	84	4.7
109	10024	1.8	21.7229	14.8	0.1398	15.1	0.0220	2.9	0.19	140.5	4.0	133	18.8	-1	358.5	140	4.0
348	14416	3.4	22.5799	10.2	0.0799	10.4	0.0131	2.3	0.22	83.8	1.9	78	7.9	-95	250.9	84	1.9

581	20793	4.6	22.0818	5.3	0.0767	5.7	0.0123	2.0	0.35	78.7	1.5	75	4.1	-40	129.5	79	1.5
485	13178	2.1	21.2235	12.9	0.0874	13.0	0.0134	1.2	0.09	86.1	1.0	85	10.6	55	309.4	86	1.0
56	80504	1.2	10.4722	1.0	3.5719	2.0	0.2713	1.7	0.85	1547.3	22.8	1543	15.5	1538	19.7	1538	19.7
240	158181	12.3	10.7735	0.7	3.2296	2.1	0.2524	2.0	0.95	1450.6	25.5	1464	16.1	1484	12.5	1484	12.5
550	29495	0.8	20.2996	2.5	0.1627	2.7	0.0240	1.1	0.40	152.6	1.6	153	3.8	160	57.3	153	1.6
515	42268	4.8	19.6844	1.8	0.2834	1.9	0.0405	0.6	0.33	255.7	1.5	253	4.2	232	41.2	256	1.5
148	75060	1.5	9.6515	0.8	4.1108	8.2	0.2878	8.2	0.99	1630.3	117.6	1656	67.1	1690	15.7	1690	15.7
93	4876	0.9	18.5436	24.2	0.1016	26.1	0.0137	9.7	0.37	87.5	8.4	98	24.4	368	553.0	87	8.4
50	27015	1.1	12.7623	2.7	2.2154	3.1	0.2051	1.5	0.49	1202.4	17.0	1186	21.9	1156	53.9	1156	53.9
700	24019	8.0	21.0865	4.0	0.0978	7.5	0.0150	6.4	0.85	95.7	6.0	95	6.8	71	94.6	96	6.0
2450	119294	2.3	20.6657	1.9	0.1025	2.2	0.0154	1.1	0.50	98.3	1.1	99	2.1	118	44.7	98	1.1
625	606485	3.9	6.4011	0.3	9.3076	1.4	0.4321	1.4	0.98	2315.2	26.7	2369	12.8	2415	4.6	2415	4.6
230	153767	1.9	9.6557	0.5	4.3051	1.4	0.3015	1.3	0.94	1698.7	20.1	1694	11.8	1689	8.9	1689	8.9
218	10327	0.7	23.8678	13.8	0.1439	13.8	0.0249	1.3	0.10	158.6	2.1	136	17.7	-233	348.9	159	2.1
478	56164	3.1	16.0089	4.0	0.3738	6.0	0.0434	4.5	0.75	273.8	12.2	322	16.7	690	85.3	274	12.2
158	4595	1.6	29.1683	12.7	0.0713	12.9	0.0151	2.7	0.21	96.6	2.6	70	8.7	-766	357.5	97	2.6
310	17762	2.3	21.6763	14.4	0.0882	14.5	0.0139	1.4	0.10	88.8	1.3	86	11.9	5	349.3	89	1.3
62	2948	0.8	15.5811	42.9	0.1066	44.6	0.0120	12.2	0.27	77.2	9.3	103	43.6	748	949.0	77	9.3
719	6912	2.2	23.3669	21.2	0.0227	21.4	0.0039	2.6	0.12	24.8	0.6	23	4.8	-179	535.0	25	0.6
405	13004	1.0	21.4338	13.9	0.0776	14.2	0.0121	3.0	0.21	77.3	2.3	76	10.4	32	334.5	77	2.3
1069	973866	3.6	11.1841	0.2	3.0499	0.9	0.2474	0.9	0.99	1425.0	11.7	1420	7.1	1413	3.1	1413	3.1
376	17037	3.6	22.9879	16.2	0.0750	16.3	0.0125	1.7	0.11	80.1	1.4	73	11.5	-139	402.6	80	1.4
29	23846	1.1	12.3768	5.1	2.2884	5.2	0.2054	1.2	0.23	1204.4	13.1	1209	37.1	1216	100.4	1216	100.4
417	206852	6.5	9.0847	0.4	4.4492	1.3	0.2932	1.2	0.96	1657.3	18.1	1722	10.7	1801	6.6	1801	6.6
166	672776	1.6	9.6635	0.5	4.1903	0.8	0.2937	0.7	0.81	1659.9	10.0	1672	7.0	1687	9.2	1687	9.2
267	145730	2.6	9.8860	3.2	1.3448	19.3	0.0964	19.0	0.99	593.4	107.6	865	112.6	1645	59.5	1645	59.5
296	14158	2.0	20.2927	12.0	0.0913	12.3	0.0134	2.8	0.23	86.1	2.4	89	10.5	161	281.9	86	2.4
130	8765	1.0	26.7895	25.4	0.0784	25.6	0.0152	3.6	0.14	97.4	3.5	77	18.9	-533	689.0	97	3.5
606	17548	1.9	21.6989	9.7	0.0850	9.8	0.0134	1.3	0.13	85.6	1.1	83	7.8	2	235.0	86	1.1
149	10242	1.1	18.9675	9.0	0.2052	9.9	0.0282	4.2	0.42	179.5	7.4	190	17.2	317	205.1	179	7.4
152	8192	1.5	23.9516	25.5	0.0782	26.1	0.0136	5.2	0.20	86.9	4.5	76	19.2	-242	654.1	87	4.5
398	12857	1.7	21.0309	8.7	0.0891	9.4	0.0136	3.5	0.38	87.0	3.0	87	7.8	77	206.7	87	3.0
326	10853	1.6	22.2550	12.8	0.0842	13.1	0.0136	2.9	0.22	87.0	2.5	82	10.4	-59	313.3	87	2.5
19	14568	1.9	12.9397	9.3	2.1071	9.8	0.1977	3.1	0.32	1163.2	33.2	1151	67.9	1128	186.3	1128	186.3
57	1834	1.1	17.3621	40.3	0.0928	41.6	0.0117	10.1	0.24	74.9	7.5	90	35.9	514	920.8	75	7.5
185	197385	2.6	9.7268	0.5	4.2448	4.0	0.2995	4.0	0.99	1688.6	58.8	1683	32.9	1675	10.0	1675	10.0
177	9469	0.9	20.1255	8.8	0.1655	9.4	0.0242	3.4	0.36	153.9	5.2	156	13.6	180	205.2	154	5.2
627	29498	2.1	20.3673	4.4	0.1056	4.6	0.0156	1.5	0.33	99.8	1.5	102	4.5	153	102.6	100	1.5
97	155620	1.5	9.7505	0.9	4.2423	1.5	0.3000	1.2	0.79	1691.4	17.3	1682	12.1	1671	16.5	1671	16.5
273	351287	2.4	9.7376	0.5	4.2969	1.0	0.3035	0.9	0.88	1708.5	13.2	1693	8.3	1673	8.8	1673	8.8

JFH-11-11M N34.47953 W118.46573

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
195	186774	2.7	9.5575	0.4	4.4131	1.1	0.3059	1.0	0.93	1720.5	15.2	1715	9.0	1708	7.2	1708	7.2
119	68563	1.1	9.6480	0.7	4.3787	2.9	0.3064	2.8	0.97	1722.9	42.9	1708	24.2	1690	13.1	1690	13.1
69	30937	0.8	12.4279	1.0	2.2823	1.3	0.2057	0.9	0.66	1206.0	9.7	1207	9.4	1208	19.6	1208	19.6
229	213346	1.0	12.4118	0.7	2.2942	1.3	0.2065	1.1	0.84	1210.2	11.9	1210	9.1	1211	13.6	1211	13.6
189	10716	0.8	21.1148	7.2	0.1395	7.6	0.0214	2.6	0.34	136.3	3.5	133	9.5	67	171.3	136	3.5
621	463550	4.1	9.4937	0.4	4.5200	1.9	0.3112	1.8	0.98	1746.7	27.8	1735	15.5	1720	7.0	1720	7.0
88	2512	0.9	22.0612	18.0	0.1467	18.5	0.0235	4.2	0.23	149.6	6.3	139	24.1	-38	440.5	150	6.3

322	31640	1.0	20.3414	7.4	0.1623	7.6	0.0240	1.9	0.25	152.6	2.8	153	10.8	156	172.4	153	2.8
197	89224	2.0	9.6805	0.7	4.2124	1.1	0.2958	0.9	0.80	1670.2	12.8	1676	9.0	1684	12.2	1684	12.2
76	24299	0.7	12.3165	2.8	2.2602	3.0	0.2019	1.1	0.35	1185.5	11.6	1200	21.4	1226	56.0	1226	56.0
1012	35425	1.4	19.2638	2.7	0.2739	2.8	0.0383	0.7	0.27	242.1	1.8	246	6.0	282	61.1	242	1.8
429	362702	2.3	9.3326	1.1	4.7830	6.2	0.3237	6.1	0.98	1808.0	96.2	1782	52.1	1752	19.8	1752	19.8
681	333442	2.9	9.4725	0.5	4.5049	3.6	0.3095	3.6	0.99	1738.2	54.8	1732	30.1	1724	8.7	1724	8.7
353	191317	1.7	9.3194	0.4	4.6209	2.3	0.3123	2.3	0.98	1752.2	34.7	1753	19.2	1754	7.5	1754	7.5
80	69341	1.4	9.7292	1.0	4.2868	3.4	0.3025	3.2	0.95	1703.7	48.1	1691	27.8	1675	19.2	1675	19.2
359	174061	3.8	9.6031	0.6	4.5276	1.4	0.3153	1.2	0.91	1766.9	19.2	1736	11.3	1699	10.4	1699	10.4
293	9229	1.2	21.8734	18.1	0.0741	18.2	0.0118	2.4	0.13	75.3	1.8	73	12.8	-17	440.1	75	1.8
335	380469	2.9	9.3235	0.5	4.6088	1.1	0.3116	0.9	0.86	1748.8	14.1	1751	8.9	1753	10.0	1753	10.0
380	211035	4.5	9.5915	0.6	4.4432	2.7	0.3091	2.6	0.97	1736.2	40.2	1720	22.5	1701	11.6	1701	11.6
259	213308	1.6	10.0493	0.3	3.8287	0.8	0.2791	0.8	0.94	1586.6	11.0	1599	6.7	1615	5.2	1615	5.2
274	253283	3.5	9.7245	0.4	4.1514	0.9	0.2928	0.8	0.92	1655.5	12.4	1664	7.5	1676	6.7	1676	6.7
963	289219	3.5	13.0202	2.9	0.7996	5.1	0.0755	4.2	0.82	469.3	18.9	597	23.0	1116	58.9	469	18.9
204	140543	2.4	9.7749	0.6	4.1427	1.1	0.2937	1.0	0.86	1660.0	14.0	1663	9.0	1666	10.3	1666	10.3
137	31204	0.9	12.4211	0.8	2.1815	0.9	0.1965	0.4	0.43	1156.6	4.2	1175	6.4	1209	16.4	1209	16.4
678	358588	2.6	9.6316	0.2	3.9850	1.0	0.2784	1.0	0.99	1583.2	14.2	1631	8.3	1694	3.0	1694	3.0
230	107118	1.1	12.3817	0.6	2.3041	1.1	0.2069	0.9	0.86	1212.3	10.5	1214	7.8	1216	11.1	1216	11.1
140	180480	1.4	9.6494	0.4	4.3022	0.7	0.3011	0.5	0.77	1696.7	7.5	1694	5.4	1690	7.7	1690	7.7
162	7019	0.8	23.5284	7.6	0.1542	7.9	0.0263	2.3	0.29	167.4	3.9	146	10.8	-197	190.1	167	3.9
328	207719	1.4	9.6193	0.3	4.2577	0.8	0.2970	0.7	0.92	1676.6	10.7	1685	6.5	1696	5.6	1696	5.6
178	73775	0.7	9.6691	0.4	4.1685	0.7	0.2923	0.5	0.76	1653.1	7.3	1668	5.4	1686	7.9	1686	7.9
447	494105	2.2	9.3883	0.2	4.5422	0.8	0.3093	0.7	0.96	1737.1	11.0	1739	6.3	1741	3.9	1741	3.9
104	89465	1.4	9.5720	0.8	4.2222	1.3	0.2931	1.1	0.82	1657.1	16.0	1678	11.0	1705	14.1	1705	14.1
2678	82349	1.0	20.9678	1.1	0.0780	1.2	0.0119	0.5	0.44	76.0	0.4	76	0.9	84	24.9	76	0.4
333	217836	1.6	9.2508	0.3	4.7032	1.0	0.3156	0.9	0.94	1768.0	13.9	1768	8.0	1768	6.1	1768	6.1
150	7111	0.7	21.4345	11.7	0.1507	11.9	0.0234	1.9	0.16	149.3	2.8	143	15.8	32	281.7	149	2.8
319	17957	0.4	20.0581	5.4	0.1596	5.6	0.0232	1.2	0.22	147.9	1.8	150	7.8	188	126.8	148	1.8
18	8970	1.3	11.9752	6.5	2.3226	6.9	0.2017	2.4	0.34	1184.6	25.5	1219	49.1	1281	126.9	1281	126.9
764	571059	19.8	10.3704	0.4	3.5932	1.3	0.2703	1.2	0.95	1542.1	16.8	1548	10.3	1556	7.8	1556	7.8
360	26452	1.7	20.4081	6.4	0.1651	6.5	0.0244	1.2	0.19	155.6	1.9	155	9.3	148	149.5	156	1.9
75	67050	0.9	9.7182	0.9	4.3322	1.2	0.3053	0.8	0.64	1717.8	11.5	1700	9.8	1677	16.8	1677	16.8
248	15349	0.6	20.6371	5.0	0.1565	5.3	0.0234	1.8	0.35	149.3	2.7	148	7.3	122	118.1	149	2.7

JFH-11-12M N34.46785 W118.47227

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
162	15386	2.0	20.3544	10.3	0.2330	10.5	0.0344	2.2	0.21	218.0	4.7	213	20.2	154	241.1	218	4.7
209	9639	1.3	18.5287	6.6	0.1969	6.9	0.0265	1.8	0.27	168.3	3.1	182	11.5	370	149.7	168	3.1
92	6993	2.1	20.9257	10.6	0.2305	11.4	0.0350	4.3	0.38	221.7	9.4	211	21.8	89	251.7	222	9.4
136	7700	1.6	20.2123	14.7	0.2376	14.9	0.0348	2.2	0.15	220.7	4.9	216	29.1	170	345.6	221	4.9
79	3689	1.0	32.0260	81.4	0.1121	81.5	0.0260	5.2	0.06	165.6	8.5	108	83.6	-1038	1266.2	166	8.5
225	12449	2.2	20.4615	5.5	0.2292	5.6	0.0340	1.3	0.23	215.6	2.8	210	10.6	142	128.1	216	2.8
372	14240	2.3	20.6079	2.9	0.2262	3.5	0.0338	1.9	0.54	214.4	4.0	207	6.6	125	69.3	214	4.0
224	84859	0.6	12.3960	0.7	2.2468	2.1	0.2020	2.0	0.93	1186.0	21.2	1196	14.7	1213	14.7	1213	14.7
160	10728	1.5	22.0051	13.5	0.2166	13.8	0.0346	2.8	0.20	219.1	6.0	199	24.9	-32	328.3	219	6.0
41	16890	1.4	12.7666	4.3	2.2195	4.4	0.2055	1.0	0.23	1204.8	10.9	1187	30.6	1155	84.5	1155	84.5
136	52178	3.8	12.7983	3.2	1.7081	4.9	0.1586	3.6	0.75	948.7	32.0	1012	31.1	1150	64.0	1150	64.0
67	87127	1.2	12.3146	2.3	2.2506	3.5	0.2010	2.7	0.76	1180.7	28.6	1197	24.5	1226	44.3	1226	44.3
204	15125	2.3	21.0126	6.1	0.2256	6.2	0.0344	1.0	0.17	217.9	2.2	207	11.6	79	144.9	218	2.2

303	22213	20.2	19.7821	3.8	0.2386	4.1	0.0342	1.6	0.39	217.0	3.4	217	8.1	220	87.7	217	3.4
91	6935	1.5	17.7918	10.5	0.2624	11.1	0.0339	3.4	0.31	214.6	7.2	237	23.4	460	234.5	215	7.2
417	124081	1.2	12.5561	0.4	2.1953	1.0	0.1999	0.9	0.92	1174.9	10.1	1180	7.1	1188	8.1	1188	8.1
156	11237	5.6	21.2601	12.2	0.2236	12.2	0.0345	1.4	0.12	218.5	3.1	205	22.7	51	291.1	219	3.1
131	24529	2.2	22.6065	17.4	0.2068	17.6	0.0339	2.6	0.15	215.0	5.4	191	30.7	-98	430.7	215	5.4
603	42276	5.5	19.8875	2.8	0.2275	3.0	0.0328	0.9	0.32	208.1	1.9	208	5.6	208	65.8	208	1.9
130	10243	2.1	20.5910	12.8	0.2327	12.9	0.0347	1.7	0.13	220.2	3.7	212	24.7	127	301.3	220	3.7
454	52819	3.1	19.3659	4.7	0.2386	4.8	0.0335	1.1	0.22	212.5	2.2	217	9.5	269	108.6	213	2.2
26	17684	2.1	12.5161	7.4	2.2772	7.6	0.2067	1.8	0.24	1211.3	20.3	1205	53.9	1194	146.4	1194	146.4
856	441699	8.3	12.4204	0.2	2.2191	0.8	0.1999	0.8	0.97	1174.8	8.3	1187	5.5	1210	3.7	1210	3.7
173	13580	2.3	18.7108	4.6	0.2544	4.9	0.0345	1.7	0.34	218.8	3.6	230	10.2	348	105.0	219	3.6
375	29498	1.8	19.9781	2.4	0.2327	3.5	0.0337	2.5	0.73	213.8	5.3	212	6.6	198	55.1	214	5.3
210	35057	1.3	19.6427	4.7	0.2524	5.3	0.0360	2.4	0.46	227.7	5.4	229	10.8	237	108.1	228	5.4
150	12987	2.4	22.7236	5.6	0.2098	6.3	0.0346	3.0	0.48	219.1	6.5	193	11.2	-110	137.2	219	6.5
156	41087	2.0	21.3823	8.8	0.2318	9.3	0.0359	2.8	0.30	227.7	6.3	212	17.7	37	212.0	228	6.3
167	24231	2.3	20.1660	6.5	0.2368	6.8	0.0346	2.0	0.29	219.5	4.3	216	13.2	176	151.0	219	4.3
124	5558	3.8	20.8668	6.8	0.2187	7.9	0.0331	4.0	0.51	209.9	8.2	201	14.3	95	160.4	210	8.2
333	35854	1.9	19.7904	2.6	0.2398	4.1	0.0344	3.1	0.76	218.1	6.7	218	8.1	219	61.2	218	6.7
126	14008	2.2	20.0415	18.6	0.2417	18.8	0.0351	2.9	0.15	222.6	6.3	220	37.2	190	436.1	223	6.3
167	14017	2.4	18.7598	5.4	0.2616	5.9	0.0356	2.5	0.42	225.4	5.4	236	12.5	342	121.8	225	5.4

JFH-11-13M N34.46159 W118.48383

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
97	215	0.3	18.4794	10.4	0.2631	10.8	0.0353	2.9	0.27	223.4	6.3	237	22.9	376	235.0	223	6.3
225	67751	1.3	12.4032	0.5	2.3154	0.9	0.2083	0.7	0.78	1219.7	7.4	1217	6.1	1212	10.5	1212	10.5
73	78709	1.0	12.4425	1.8	2.2540	1.9	0.2034	0.7	0.39	1193.6	8.1	1198	13.4	1206	34.6	1206	34.6
223	117623	3.1	10.6193	1.1	3.1715	3.3	0.2443	3.1	0.94	1408.8	39.8	1450	25.8	1511	21.1	1511	21.1
53	18027	1.8	12.3126	3.1	2.2885	3.4	0.2044	1.4	0.40	1198.7	14.9	1209	24.2	1227	61.6	1227	61.6
440	23021	452.7	20.0435	3.1	0.2337	3.1	0.0340	0.5	0.15	215.4	1.0	213	6.0	190	72.1	215	1.0
39	15625	1.6	12.7178	3.2	2.1751	3.4	0.2006	1.1	0.33	1178.7	12.2	1173	23.8	1163	63.9	1163	63.9
140	9600	2.1	20.3142	4.8	0.2338	5.0	0.0344	1.4	0.28	218.3	3.1	213	9.7	159	112.8	218	3.1
101	15282	1.3	12.2582	3.7	2.3267	3.8	0.2069	1.1	0.29	1212.0	12.2	1220	27.2	1235	72.0	1235	72.0
120	77266	2.0	10.7580	2.9	2.9199	4.7	0.2278	3.6	0.78	1323.1	43.5	1387	35.2	1487	55.1	1487	55.1
61	24203	1.1	12.6188	1.9	2.1568	3.0	0.1974	2.3	0.76	1161.3	24.2	1167	20.7	1178	38.1	1178	38.1
58	51519	1.4	12.4580	2.2	2.2249	2.5	0.2010	1.1	0.45	1180.8	12.1	1189	17.4	1204	43.6	1204	43.6
130	133535	1.4	12.4743	1.6	2.2554	1.7	0.2041	0.7	0.43	1197.0	8.2	1198	12.2	1201	30.8	1201	30.8
64	44719	1.1	12.3475	2.5	2.2705	3.0	0.2033	1.6	0.53	1193.2	17.2	1203	20.9	1221	49.3	1221	49.3
591	20952	6.6	12.5304	0.5	2.1454	2.4	0.1950	2.3	0.97	1148.2	24.2	1164	16.3	1192	10.5	1192	10.5
110	13428	1.6	14.1109	3.9	0.6935	7.5	0.0710	6.4	0.86	442.0	27.3	535	31.1	954	79.4	442	27.3
248	17826	16.1	19.6179	5.7	0.2225	5.8	0.0317	1.1	0.20	200.9	2.2	204	10.7	240	130.9	201	2.2
260	230361	2.0	9.4122	0.8	4.5514	2.2	0.3107	2.1	0.94	1744.1	31.9	1740	18.5	1736	14.1	1736	14.1
61	23945	1.2	12.4070	1.3	2.3444	1.5	0.2110	0.8	0.53	1233.9	9.1	1226	10.8	1212	25.4	1212	25.4
72	6082	2.1	23.8151	28.6	0.2029	28.8	0.0350	3.2	0.11	222.0	7.0	188	49.3	-227	733.5	222	7.0
512	19541	1.2	20.2047	3.1	0.1775	3.2	0.0260	0.9	0.28	165.5	1.4	166	4.9	171	71.5	165	1.4
29	13406	1.3	12.4992	3.8	2.2212	4.4	0.2014	2.3	0.51	1182.6	24.5	1188	31.0	1197	75.0	1197	75.0
560	73492	4.6	19.8435	1.4	0.2352	3.0	0.0338	2.7	0.88	214.6	5.7	214	5.9	213	32.9	215	5.7
54	26533	1.4	12.3983	3.0	2.2800	3.1	0.2050	0.8	0.27	1202.2	9.1	1206	22.1	1213	59.4	1213	59.4
53	35488	0.9	12.4675	2.7	2.2445	2.9	0.2029	1.1	0.36	1191.1	11.5	1195	20.6	1202	53.9	1202	53.9
137	15220	1.7	18.6299	6.7	0.2643	7.1	0.0357	2.3	0.32	226.2	5.1	238	15.0	358	151.1	226	5.1
41	38813	1.2	12.3194	3.4	2.3220	3.6	0.2075	1.2	0.34	1215.3	13.5	1219	25.3	1226	65.8	1226	65.8

183	24239	1.5	20.6463	5.1	0.2321	5.3	0.0347	1.6	0.29	220.2	3.4	212	10.1	121	119.2	220	3.4
67	43300	1.4	9.9036	1.4	4.1571	1.8	0.2986	1.1	0.60	1684.3	16.2	1666	14.8	1642	26.9	1642	26.9
149	20452	2.0	19.2665	9.0	0.2514	9.0	0.0351	1.0	0.11	222.6	2.1	228	18.4	281	205.7	223	2.1
406	27211	1.6	20.1133	4.2	0.2331	4.3	0.0340	0.9	0.20	215.6	1.8	213	8.3	182	98.8	216	1.8
484	22043	2.2	19.4355	3.6	0.2318	4.5	0.0327	2.7	0.60	207.3	5.6	212	8.7	261	82.9	207	5.6
165	15023	1.8	18.9756	6.8	0.2523	7.1	0.0347	2.0	0.28	220.0	4.3	228	14.6	316	155.5	220	4.3
285	17699	1.3	18.7148	3.9	0.2707	4.0	0.0367	1.0	0.25	232.6	2.3	243	8.6	347	87.4	233	2.3
121	10833	1.2	19.6276	9.1	0.2447	9.2	0.0348	1.4	0.15	220.7	3.0	222	18.4	239	211.1	221	3.0
38	15700	1.1	12.5691	2.4	2.1875	2.6	0.1994	0.9	0.36	1172.2	9.8	1177	17.8	1186	47.1	1186	47.1
140	25368	2.3	19.1695	7.2	0.2461	7.4	0.0342	1.4	0.19	216.9	2.9	223	14.8	293	165.3	217	2.9
43	43085	1.4	10.3973	1.8	3.5310	2.1	0.2663	1.0	0.50	1521.8	14.1	1534	16.4	1551	33.6	1551	33.6
104	71210	1.4	12.4199	1.5	2.2501	1.6	0.2027	0.5	0.34	1189.7	5.9	1197	11.4	1210	30.1	1210	30.1
88	56245	2.4	12.4133	0.9	2.2134	2.1	0.1993	1.9	0.90	1171.4	20.6	1185	15.0	1211	18.3	1211	18.3
514	198224	1.9	12.5769	0.5	2.1400	2.5	0.1952	2.5	0.98	1149.5	26.1	1162	17.5	1185	9.8	1185	9.8
584	663746	11.6	9.7856	0.2	4.1019	0.7	0.2911	0.7	0.96	1647.1	9.8	1655	5.7	1664	3.4	1664	3.4

JFH-11-14M N34.51272 W118.53443

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
580	476827	11.6	9.6395	0.3	4.2349	1.8	0.2961	1.7	0.99	1671.8	25.7	1681	14.5	1692	4.7	1692	4.7
466	383225	2.8	9.4658	0.2	4.5479	1.0	0.3122	1.0	0.99	1751.6	14.6	1740	8.1	1726	3.0	1726	3.0
115	61083	1.7	9.6649	1.0	4.3150	1.6	0.3025	1.3	0.79	1703.5	19.3	1696	13.5	1687	18.7	1687	18.7
551	50864	1.9	20.3845	4.4	0.1574	4.6	0.0233	1.2	0.27	148.3	1.8	148	6.3	151	102.8	148	1.8
445	5515	0.8	19.7660	5.7	0.1853	6.1	0.0266	2.2	0.36	169.0	3.6	173	9.6	222	131.3	169	3.6
564	580158	2.2	9.6060	0.1	4.2434	1.1	0.2956	1.1	0.99	1669.6	15.6	1682	8.8	1698	2.7	1698	2.7
63	71755	2.1	9.2108	1.2	4.6432	1.6	0.3102	1.1	0.69	1741.6	16.8	1757	13.3	1776	21.0	1776	21.0
329	1079	0.4	19.1418	19.1	0.0856	19.4	0.0119	3.2	0.17	76.2	2.4	83	15.5	296	439.3	76	2.4
322	20370	0.5	21.7512	7.2	0.1509	7.6	0.0238	2.4	0.31	151.7	3.5	143	10.1	4	174.9	152	3.5
950	28928	0.4	20.4198	2.0	0.1798	2.1	0.0266	0.6	0.30	169.4	1.0	168	3.2	147	46.0	169	1.0
278	200273	9.5	9.6393	0.4	4.2050	1.1	0.2940	1.0	0.92	1661.3	14.2	1675	8.6	1692	7.5	1692	7.5
60	104601	1.1	12.3914	1.6	2.2702	2.7	0.2040	2.2	0.81	1196.9	24.1	1203	19.3	1214	31.7	1214	31.7
19	10890	1.3	12.5747	8.0	2.2773	8.3	0.2077	2.2	0.27	1216.5	24.8	1205	58.6	1185	158.0	1185	158.0
881	312303	2.5	9.2289	0.2	4.6784	0.9	0.3131	0.9	0.98	1756.2	13.3	1763	7.4	1772	3.4	1772	3.4
69	44089	1.4	9.6254	1.0	4.4576	1.4	0.3112	1.0	0.69	1746.5	15.2	1723	11.9	1695	19.3	1695	19.3
95	4757	0.9	20.8038	42.1	0.0865	43.6	0.0131	11.1	0.26	83.6	9.2	84	35.2	103	1037.5	84	9.2
1185	650287	2.7	12.4536	0.2	2.2360	0.9	0.2020	0.9	0.98	1185.8	10.1	1192	6.7	1204	3.3	1204	3.3
87	55422	1.4	12.2605	2.6	2.2453	2.7	0.1997	0.8	0.31	1173.5	9.0	1195	19.1	1235	50.7	1235	50.7
58	16644	1.3	9.6554	2.3	4.2260	2.5	0.2959	1.2	0.46	1671.1	17.3	1679	20.9	1689	41.7	1689	41.7
256	213159	1.8	9.6002	0.4	4.3194	1.3	0.3007	1.2	0.94	1695.0	18.5	1697	10.8	1700	8.0	1700	8.0
214	219818	1.0	9.7052	0.5	4.1694	2.3	0.2935	2.3	0.98	1658.9	33.4	1668	19.1	1680	9.0	1680	9.0
138	761	0.6	18.9310	19.6	0.1851	20.0	0.0254	3.9	0.20	161.8	6.3	172	31.7	321	449.3	162	6.3
44	27131	1.0	12.5819	2.2	2.1707	2.4	0.1981	1.1	0.44	1165.0	11.2	1172	16.9	1184	43.1	1184	43.1
18	3747	1.5	12.1396	9.7	2.2260	10.5	0.1960	4.1	0.39	1153.8	43.3	1189	74.0	1254	190.4	1254	190.4
58	43365	1.2	12.3460	1.6	2.1790	1.7	0.1951	0.7	0.42	1149.0	7.7	1174	12.1	1221	30.9	1221	30.9
194	10607	2.1	20.9780	10.1	0.2193	10.2	0.0334	1.1	0.11	211.5	2.3	201	18.6	83	240.8	212	2.3
419	16402	1.9	20.3542	6.7	0.0806	7.1	0.0119	2.5	0.35	76.2	1.9	79	5.4	154	156.2	76	1.9
139	63154	3.4	12.5960	0.8	2.1868	1.1	0.1998	0.7	0.66	1174.1	7.6	1177	7.4	1182	15.9	1182	15.9
36	14775	1.4	12.4549	2.6	2.2886	3.0	0.2067	1.6	0.52	1211.4	17.3	1209	21.4	1204	50.9	1204	50.9
43	49524	1.6	12.3131	3.8	2.3433	4.0	0.2093	1.3	0.32	1224.9	14.0	1226	28.2	1227	73.7	1227	73.7
421	92667	2.4	9.4132	0.5	4.6851	2.4	0.3199	2.4	0.98	1789.0	36.8	1765	20.2	1736	9.4	1736	9.4
180	96485	2.8	12.4340	0.7	2.3319	2.1	0.2103	2.0	0.94	1230.4	22.2	1222	15.0	1207	14.4	1207	14.4

145	78597	1.8	12.3668	1.0	2.2984	1.3	0.2062	0.8	0.66	1208.3	9.2	1212	9.0	1218	18.7	1218	18.7
150	56019	1.4	12.4377	1.1	2.3032	1.2	0.2078	0.6	0.47	1216.9	6.4	1213	8.7	1207	21.4	1207	21.4
109	82432	1.8	9.6413	1.0	4.2088	1.0	0.2943	0.2	0.17	1663.0	2.5	1676	8.2	1692	18.2	1692	18.2
397	19190	2.1	21.6985	15.0	0.0794	15.8	0.0125	4.8	0.31	80.0	3.9	78	11.8	2	363.9	80	3.9
103	95815	1.6	12.6039	1.7	2.2060	1.9	0.2017	0.8	0.44	1184.2	9.0	1183	13.2	1181	33.5	1181	33.5
144	77621	0.8	12.4102	1.3	2.2412	2.1	0.2017	1.7	0.79	1184.6	18.3	1194	15.0	1211	25.4	1211	25.4
116	3579	1.0	23.3846	35.8	0.0706	36.3	0.0120	5.9	0.16	76.8	4.5	69	24.3	-181	919.5	77	4.5
158	76859	1.3	12.2758	0.7	2.2869	1.0	0.2036	0.7	0.72	1194.7	7.7	1208	6.9	1233	13.4	1233	13.4

JFH-11-15C N34.79050 W119.04295

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
281	16509	2.4	20.9666	8.0	0.2199	9.7	0.0334	5.5	0.57	212.0	11.4	202	17.7	84	189.6	212	11.4
26	12650	1.9	12.3609	6.7	2.2684	7.2	0.2034	2.7	0.37	1193.3	29.4	1203	51.0	1219	132.0	1219	132.0
68	16713	1.8	12.6515	3.3	2.1258	3.5	0.1951	1.2	0.35	1148.7	12.9	1157	24.4	1173	65.7	1173	65.7
115	10252	2.1	21.2727	17.1	0.2203	17.3	0.0340	2.2	0.12	215.5	4.6	202	31.6	50	411.3	215	4.6
198	17450	1.5	20.5535	12.3	0.2366	12.5	0.0353	2.4	0.19	223.5	5.3	216	24.3	131	289.6	223	5.3
161	16442	2.7	20.8787	14.5	0.2297	14.8	0.0348	2.6	0.18	220.4	5.7	210	28.0	94	346.1	220	5.7
44	28187	1.4	12.6193	4.2	2.2231	4.6	0.2035	2.0	0.44	1193.9	22.0	1188	32.5	1178	82.5	1178	82.5
21	7845	1.8	12.6348	7.5	2.1383	7.9	0.1959	2.5	0.31	1153.5	26.0	1161	54.8	1176	149.1	1176	149.1
62	43893	1.2	9.7326	1.7	4.1049	2.4	0.2898	1.7	0.70	1640.3	24.7	1655	19.9	1674	32.3	1674	32.3
223	15231	2.6	19.5789	10.0	0.2435	10.2	0.0346	1.7	0.17	219.1	3.7	221	20.2	244	231.1	219	3.7
899	170918	3.1	19.6696	1.1	0.2353	1.4	0.0336	0.9	0.66	212.8	1.9	215	2.7	234	24.4	213	1.9
176	7693	2.0	21.9233	10.8	0.2143	11.1	0.0341	2.6	0.23	216.0	5.5	197	19.9	-23	262.8	216	5.5
146	110565	3.0	11.1729	0.9	2.8523	1.4	0.2311	1.1	0.78	1340.4	12.8	1369	10.3	1415	16.5	1415	16.5
239	113635	8.5	11.3186	0.6	2.6940	1.0	0.2212	0.9	0.84	1288.0	10.2	1327	7.7	1390	10.9	1390	10.9
58	35673	1.3	12.1271	2.0	2.3311	2.7	0.2050	1.7	0.65	1202.3	19.0	1222	19.0	1256	39.9	1256	39.9
198	154040	1.4	11.4655	0.7	2.7467	1.3	0.2284	1.1	0.83	1326.1	12.8	1341	9.5	1365	13.6	1365	13.6
143	21885	2.1	20.1322	14.1	0.2384	14.6	0.0348	3.7	0.25	220.6	8.0	217	28.5	180	330.2	221	8.0
178	7991	1.8	20.4026	8.9	0.2300	9.3	0.0340	2.6	0.28	215.7	5.5	210	17.6	148	208.6	216	5.5
43	18284	0.9	12.4975	3.2	2.2934	4.3	0.2079	2.8	0.67	1217.5	31.5	1210	30.2	1197	62.8	1197	62.8
585	22296	5.2	19.4000	6.3	0.2316	7.4	0.0326	3.9	0.53	206.8	8.0	212	14.1	265	143.9	207	8.0
165	22580	3.1	20.7898	9.2	0.2245	9.5	0.0339	2.4	0.25	214.6	5.0	206	17.8	104	218.7	215	5.0
73	85160	1.3	12.3837	2.7	2.2619	2.9	0.2032	1.1	0.38	1192.2	11.8	1201	20.3	1215	52.7	1215	52.7
97	71454	1.9	12.4273	2.7	2.2117	2.8	0.1993	1.0	0.35	1171.8	10.5	1185	19.8	1208	52.4	1208	52.4
155	1772	1.9	8.0673	148.7	0.0660	153.2	0.0039	36.7	0.24	24.8	9.1	65	96.6	2014	93.7	25	9.1
169	3776	2.7	12.8657	147.0	0.0427	148.3	0.0040	19.4	0.13	25.7	5.0	42	61.8	1140	507.3	26	5.0
28	16892	1.7	12.1532	7.4	2.2700	8.2	0.2001	3.4	0.41	1175.8	36.3	1203	57.7	1252	145.8	1252	145.8
368	110854	1.7	12.4176	0.5	2.2469	0.8	0.2024	0.6	0.74	1188.0	6.2	1196	5.5	1210	10.4	1210	10.4
589	271497	4.8	16.9242	1.1	0.7666	1.3	0.0941	0.6	0.45	579.7	3.1	578	5.5	570	24.4	580	3.1
177	10951	2.5	19.6956	12.2	0.2446	12.7	0.0349	3.5	0.27	221.4	7.6	222	25.3	231	282.6	221	7.6
94	35760	1.4	12.3705	1.7	2.2946	2.9	0.2059	2.4	0.82	1206.8	26.3	1211	20.7	1218	33.2	1218	33.2
1157	9197	2.4	21.2860	11.5	0.0258	11.7	0.0040	2.5	0.21	25.6	0.6	26	3.0	48	274.7	26	0.6

JFH-11-16C N34.72091 W119.19413

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
1591	3244673	1.6	9.4557	0.1	4.3928	0.5	0.3013	0.5	0.96	1697.5	7.7	1711	4.4	1727	2.6	1727	2.6
114	551695	0.7	9.8412	0.8	3.8452	1.5	0.2745	1.2	0.85	1563.4	17.1	1602	11.7	1654	14.4	1654	14.4
320	651	0.5	9.8230	4.0	0.1711	5.4	0.0122	3.7	0.68	78.1	2.8	160	8.0	1657	73.2	78	2.8
90	8018	6.0	23.1721	89.0	0.0794	89.6	0.0133	10.8	0.12	85.5	9.2	78	67.0	-159	2984.3	85	9.2

22	2860	1.3	1.1870	827.2	2.6364	827.5	0.0227	21.7	0.03	144.7	31.1	1311	#NUM!	NA	NA	145	31.1
77	9296	4.7	30.7737	55.1	0.0608	55.7	0.0136	8.3	0.15	87.0	7.2	60	32.5	-920	1716.4	87	7.2
250	583	0.5	9.6323	6.0	0.1730	6.8	0.0121	3.2	0.47	77.4	2.5	162	10.2	1693	110.4	77	2.5
147	371	0.4	7.3949	10.2	0.2344	12.6	0.0126	7.5	0.59	80.5	6.0	214	24.4	2167	178.1	81	6.0
169	531802	2.3	9.7230	0.4	4.2004	0.9	0.2962	0.8	0.90	1672.5	11.5	1674	7.1	1676	6.9	1676	6.9
30	7230	0.6	-5.0579	691.7	-0.6442	691.9	0.0236	16.2	0.02	150.6	24.2	-1049	#NUM!	NA	NA	151	24.2
171	28627	0.8	20.0434	11.0	0.1638	12.4	0.0238	5.6	0.46	151.7	8.4	154	17.7	190	256.6	152	8.4
66	18276	1.1	22.5232	30.4	0.1457	30.9	0.0238	5.5	0.18	151.7	8.3	138	39.9	-89	759.7	152	8.3
297	30943	1.2	25.5218	25.1	0.0669	25.5	0.0124	4.4	0.17	79.3	3.5	66	16.2	-405	663.9	79	3.5
547	40867	3.5	21.9139	7.3	0.0783	7.8	0.0124	2.7	0.35	79.7	2.2	77	5.8	-22	177.6	80	2.2
260	30346	1.1	21.4533	13.3	0.0791	13.9	0.0123	4.0	0.29	78.9	3.1	77	10.4	29	321.1	79	3.1
79	10790	0.3	24.0930	37.9	0.1410	38.4	0.0246	5.9	0.15	156.9	9.1	134	48.2	-256	991.6	157	9.1
716	1262	1.4	13.8903	3.6	0.1174	4.1	0.0118	2.0	0.49	75.8	1.5	113	4.4	986	73.4	76	1.5
68	90903	1.1	12.7167	2.2	2.1136	2.6	0.1949	1.4	0.53	1148.1	14.4	1153	17.6	1163	42.9	1163	42.9
16	5022	0.6	9.3278	173.0	0.3586	173.8	0.0243	16.7	0.10	154.5	25.4	311	503.3	1752	199.3	155	25.4
200	441	0.4	7.4108	39.8	0.2766	40.8	0.0149	8.9	0.22	95.1	8.4	248	90.0	2163	727.1	95	8.4
171	460	0.5	8.2208	8.3	0.2011	10.2	0.0120	5.9	0.58	76.9	4.5	186	17.3	1980	147.9	77	4.5
191	466	2.8	7.8607	3.1	0.2242	4.7	0.0128	3.5	0.74	81.9	2.8	205	8.7	2060	55.6	82	2.8
23	3703	1.3	15.8851	114.5	0.2060	115.3	0.0237	13.3	0.11	151.2	19.8	190	202.6	707	613.8	151	19.8
319	1108	7.1	12.8945	7.5	0.1299	7.8	0.0121	2.1	0.27	77.8	1.6	124	9.1	1135	149.8	78	1.6
79	16895	1.7	18.8356	18.1	0.1687	19.0	0.0230	5.7	0.30	146.9	8.2	158	27.8	333	413.2	147	8.2
216	559	0.6	9.4770	7.7	0.1757	8.6	0.0121	3.8	0.44	77.4	2.9	164	13.0	1723	141.7	77	2.9
17	2390	1.1	15.0400	96.0	0.2114	98.6	0.0231	22.5	0.23	147.0	32.7	195	176.4	822	397.9	147	32.7
168	410	0.5	7.6957	7.7	0.2157	8.5	0.0120	3.7	0.43	77.2	2.8	198	15.4	2097	135.6	77	2.8
56	25958	1.0	21.2652	37.0	0.1448	37.7	0.0223	7.5	0.20	142.4	10.5	137	48.5	51	910.6	142	10.5
96	16822	0.5	20.1389	17.5	0.1575	17.9	0.0230	4.1	0.23	146.6	5.9	149	24.8	179	409.7	147	5.9
123	12324	3.6	24.4250	30.7	0.0769	31.5	0.0136	7.1	0.22	87.2	6.1	75	22.8	-291	798.9	87	6.1
196	412	0.6	7.3669	6.8	0.2419	7.7	0.0129	3.8	0.49	82.8	3.1	220	15.3	2174	118.1	83	3.1
281	748	0.8	10.1004	5.5	0.1647	5.8	0.0121	2.0	0.35	77.3	1.6	155	8.4	1605	102.0	77	1.6
34	6903	1.6	24.7646	154.4	0.1292	154.6	0.0232	9.1	0.06	147.9	13.3	123	181.5	-327	0.0	148	13.3
99	13274	1.2	25.8354	32.5	0.1250	32.7	0.0234	4.0	0.12	149.3	6.0	120	36.9	-437	872.3	149	6.0
657	135233	0.7	20.2562	1.8	0.1628	2.1	0.0239	1.0	0.49	152.4	1.5	153	2.9	165	41.9	152	1.5
550	1088419	18.0	10.5648	2.9	2.9439	6.3	0.2256	5.6	0.89	1311.2	66.1	1393	47.6	1521	54.3	1521	54.3
225	513859	2.3	10.0607	0.5	3.7734	2.2	0.2753	2.2	0.97	1567.8	30.0	1587	17.9	1613	10.2	1613	10.2
261	1132310	4.3	9.5334	0.3	4.4542	2.5	0.3080	2.5	0.99	1730.7	37.8	1722	20.8	1712	5.2	1712	5.2
500	66786	28.8	9.8528	2.8	3.5853	5.5	0.2562	4.8	0.86	1470.4	62.9	1546	44.0	1652	51.7	1652	51.7

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U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
173	129376	2.0	9.6799	0.7	4.2060	1.2	0.2953	1.0	0.83	1667.9	14.9	1675	10.0	1684	12.4	1684	12.4
151	264278	1.5	9.6543	0.5	4.2556	0.7	0.2980	0.5	0.71	1681.2	7.6	1685	5.9	1689	9.3	1689	9.3
41	36198	1.7	12.3765	3.7	2.2763	3.8	0.2043	1.1	0.29	1198.5	12.3	1205	27.0	1217	71.9	1217	71.9
326	293685	23.5	9.6504	0.4	4.2050	1.1	0.2943	1.0	0.94	1663.1	15.1	1675	9.1	1690	7.2	1690	7.2
38	24646	1.4	12.4613	5.4	2.2167	5.7	0.2003	1.9	0.33	1177.2	20.4	1186	39.8	1203	105.6	1203	105.6
24	14258	1.6	12.2301	5.4	2.2691	6.0	0.2013	2.6	0.43	1182.1	27.7	1203	42.4	1240	106.8	1240	106.8
201	276035	1.4	9.6579	0.5	4.2596	0.7	0.2984	0.5	0.76	1683.2	8.0	1686	5.9	1689	8.6	1689	8.6
55	20236	1.2	12.3492	3.8	2.3520	4.0	0.2107	1.2	0.30	1232.3	13.3	1228	28.4	1221	74.7	1221	74.7
29	17431	1.3	12.6884	6.4	2.2215	6.6	0.2044	1.6	0.25	1199.1	17.8	1188	46.3	1167	127.1	1167	127.1
51	23444	1.5	12.5408	3.2	2.2743	3.3	0.2069	0.9	0.28	1212.0	10.3	1204	23.4	1191	62.7	1191	62.7
302	141569	0.8	12.4208	0.6	2.2694	0.8	0.2044	0.5	0.67	1199.1	5.6	1203	5.4	1210	11.2	1210	11.2

274	207241	2.3	12.4179	0.5	2.2607	0.8	0.2036	0.7	0.77	1194.7	7.1	1200	6.0	1210	10.6	1210	10.6
28	15004	1.4	12.8349	3.6	2.1821	3.9	0.2031	1.5	0.39	1192.1	16.3	1175	26.9	1145	70.8	1145	70.8
603	552641	56.9	9.9197	1.3	3.8088	1.9	0.2740	1.5	0.75	1561.2	20.2	1595	15.6	1639	23.8	1639	23.8
1248	112246	13.3	9.7125	0.2	4.1326	1.1	0.2911	1.1	0.99	1647.0	16.1	1661	9.2	1678	2.9	1678	2.9
45	15193	1.4	12.7269	4.4	2.1617	4.5	0.1995	0.9	0.21	1172.8	10.1	1169	30.9	1161	86.3	1161	86.3
180	136287	3.2	9.7687	0.5	4.1691	0.8	0.2954	0.7	0.81	1668.4	10.0	1668	6.9	1667	9.0	1667	9.0
35	18360	2.0	12.8228	4.7	2.1533	4.8	0.2003	1.3	0.26	1176.7	13.7	1166	33.5	1147	92.7	1147	92.7
291	460616	4.9	9.6416	0.3	4.2456	1.5	0.2969	1.4	0.98	1675.8	21.0	1683	11.9	1692	5.3	1692	5.3
281	265294	2.6	9.7550	0.4	4.1425	0.7	0.2931	0.6	0.84	1656.9	8.2	1663	5.5	1670	6.6	1670	6.6
139	109788	1.5	9.6967	0.9	4.2647	1.3	0.2999	1.0	0.75	1690.9	15.0	1687	11.1	1681	16.6	1681	16.6
166	88529	0.8	12.6122	0.9	2.1899	1.1	0.2003	0.6	0.56	1177.0	6.6	1178	7.7	1179	18.1	1179	18.1
100	149420	1.4	12.5551	1.7	2.2568	2.0	0.2055	1.0	0.48	1204.8	10.7	1199	14.1	1188	34.6	1188	34.6
60	81683	1.9	12.6310	3.9	2.2264	4.3	0.2040	1.7	0.40	1196.6	18.7	1189	30.1	1176	78.0	1176	78.0
101	100918	1.2	10.0051	0.7	3.7312	2.4	0.2707	2.4	0.96	1544.6	32.3	1578	19.6	1623	12.5	1623	12.5
251	172404	2.0	9.6621	0.5	4.1602	0.8	0.2915	0.7	0.83	1649.2	9.9	1666	6.8	1688	8.6	1688	8.6
63	43754	1.0	9.6806	2.0	4.1874	2.6	0.2940	1.8	0.67	1661.5	26.0	1672	21.6	1684	36.1	1684	36.1
64	29201	1.1	12.7152	2.1	2.2224	2.4	0.2049	1.0	0.42	1201.8	10.8	1188	16.5	1163	42.5	1163	42.5
236	138011	38.3	11.0139	0.5	3.0527	1.1	0.2439	1.0	0.90	1406.7	12.3	1421	8.3	1442	8.8	1442	8.8
115	47715	0.7	12.4506	1.8	2.2824	1.9	0.2061	0.7	0.38	1208.0	8.0	1207	13.6	1205	35.2	1205	35.2
54	65503	1.0	9.5672	1.7	4.3698	3.1	0.3032	2.5	0.82	1707.2	38.1	1707	25.5	1706	32.2	1706	32.2
56	65904	0.5	12.3578	3.0	2.2899	4.1	0.2052	2.7	0.67	1203.4	29.9	1209	28.9	1219	59.9	1219	59.9
203	128283	3.5	9.6808	0.8	4.2952	1.3	0.3016	1.0	0.80	1699.1	15.4	1692	10.7	1684	14.4	1684	14.4
71	38582	1.0	12.3792	1.3	2.3087	2.7	0.2073	2.3	0.88	1214.3	25.8	1215	18.8	1216	25.1	1216	25.1
79	69709	1.1	9.6743	1.3	4.2977	1.8	0.3015	1.2	0.69	1699.0	18.2	1693	14.6	1685	23.7	1685	23.7
103	112037	1.0	9.6200	0.8	4.3555	1.2	0.3039	0.9	0.72	1710.6	13.3	1704	10.1	1696	15.5	1696	15.5
267	73680	3.9	9.6340	0.6	4.4721	3.2	0.3125	3.1	0.98	1752.9	47.6	1726	26.2	1693	11.1	1693	11.1
260	143885	2.8	9.7461	0.4	4.3899	1.5	0.3103	1.4	0.96	1742.2	22.0	1710	12.4	1672	7.8	1672	7.8
483	21603	13.8	9.7312	0.6	4.2968	1.4	0.3033	1.3	0.91	1707.4	18.9	1693	11.4	1675	10.7	1675	10.7

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U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
286	261688	18.7	9.7076	0.2	4.1285	0.5	0.2907	0.4	0.86	1644.9	6.1	1660	4.0	1679	4.6	1679	4.6
533	337397	4.7	9.7414	0.2	4.0970	0.6	0.2895	0.6	0.96	1638.8	8.4	1654	4.9	1673	3.1	1673	3.1
25	14242	1.7	12.7752	6.8	2.1455	7.1	0.1988	1.9	0.27	1168.8	20.2	1164	49.2	1154	136.0	1154	136.0
67	36443	1.9	12.5746	2.5	2.1793	2.7	0.1987	1.1	0.40	1168.6	11.7	1174	18.8	1185	48.9	1185	48.9
55	14284	1.9	12.7353	3.6	2.1339	3.7	0.1971	0.8	0.23	1159.7	8.9	1160	25.6	1160	71.6	1160	71.6
145	95232	1.1	9.7191	0.9	4.1419	1.4	0.2920	1.0	0.75	1651.3	15.1	1663	11.3	1677	16.9	1677	16.9
262	74949	1.4	12.4738	0.6	2.2169	1.3	0.2006	1.2	0.90	1178.3	12.7	1186	9.1	1201	11.1	1201	11.1
116	52328	1.4	12.4194	0.9	2.2429	1.2	0.2020	0.8	0.66	1186.2	8.8	1195	8.6	1210	18.1	1210	18.1
81	56649	0.9	12.3700	1.3	2.2323	1.5	0.2003	0.9	0.55	1176.8	9.2	1191	10.8	1218	25.4	1218	25.4
53	30941	1.3	12.5592	2.3	2.1979	2.6	0.2002	1.3	0.50	1176.4	14.2	1180	18.4	1188	44.9	1188	44.9
30	20270	1.4	12.8699	5.1	2.1558	5.3	0.2012	1.4	0.27	1181.9	15.6	1167	36.6	1139	100.9	1139	100.9
64	41041	1.0	12.3588	2.7	2.2752	2.8	0.2039	0.6	0.22	1196.4	6.6	1205	19.6	1219	53.3	1219	53.3
67	17319	0.9	12.5226	3.0	2.2382	3.3	0.2033	1.4	0.41	1192.9	14.7	1193	23.2	1193	59.5	1193	59.5
65	43190	2.0	12.5226	1.3	2.1807	3.2	0.1981	2.9	0.91	1164.9	31.4	1175	22.4	1193	25.7	1193	25.7
52	41501	1.1	12.4188	1.8	2.2747	2.6	0.2049	1.8	0.70	1201.5	19.8	1204	18.0	1210	35.7	1210	35.7
62	66480	1.2	12.4789	1.6	2.2067	1.8	0.1997	0.8	0.46	1173.8	9.0	1183	12.6	1200	31.5	1200	31.5
34	17565	1.6	12.5991	5.6	2.1555	5.8	0.1970	1.3	0.22	1159.0	13.4	1167	39.9	1181	111.0	1181	111.0
176	288072	1.6	9.6458	0.8	4.1246	4.5	0.2886	4.5	0.98	1634.3	64.4	1659	37.0	1691	14.7	1691	14.7
19	10018	1.3	12.6465	4.8	2.1704	6.6	0.1991	4.6	0.69	1170.3	49.2	1172	46.0	1174	94.2	1174	94.2

214	105249	1.4	12.4363	0.5	2.2925	1.4	0.2068	1.3	0.93	1211.6	14.4	1210	9.9	1207	10.0	1207	10.0
151	138525	1.7	9.6451	0.7	4.3055	1.6	0.3012	1.4	0.89	1697.2	20.9	1694	13.0	1691	13.3	1691	13.3
53	35504	0.7	12.3861	3.3	2.2601	3.9	0.2030	2.0	0.52	1191.6	21.9	1200	27.5	1215	65.8	1215	65.8
273	174383	9.5	12.4902	0.8	2.2024	1.1	0.1995	0.7	0.67	1172.7	7.7	1182	7.5	1199	15.8	1199	15.8
165	41945	1.9	9.7329	0.7	4.1550	0.9	0.2933	0.5	0.57	1658.0	7.3	1665	7.1	1674	13.2	1674	13.2
274	91295	1.3	12.4565	0.6	2.2158	0.8	0.2002	0.5	0.60	1176.3	4.9	1186	5.3	1204	11.8	1204	11.8
664	271044	0.8	12.5095	0.3	2.2446	2.0	0.2036	2.0	0.99	1194.9	21.9	1195	14.3	1195	6.1	1195	6.1
89	94960	1.4	9.6647	0.9	4.3671	2.9	0.3061	2.8	0.95	1721.5	41.8	1706	24.0	1687	16.4	1687	16.4
143	3235	1.9	9.4592	5.7	4.2961	6.2	0.2947	2.4	0.39	1665.1	35.1	1693	50.8	1727	104.3	1727	104.3
319	304582	4.7	9.7272	0.4	4.0875	1.5	0.2884	1.5	0.97	1633.3	21.1	1652	12.3	1675	6.6	1675	6.6
58	33624	2.5	12.3406	2.9	2.1909	3.2	0.1961	1.3	0.42	1154.3	14.2	1178	22.4	1222	57.3	1222	57.3
204	105252	2.3	9.6970	0.4	4.1655	1.4	0.2930	1.3	0.95	1656.3	19.7	1667	11.6	1681	7.9	1681	7.9
93	42804	0.9	12.5608	0.9	2.2098	1.8	0.2013	1.6	0.86	1182.4	16.8	1184	12.6	1187	18.1	1187	18.1
363	243367	2.9	9.6683	0.2	4.1954	1.5	0.2942	1.4	0.99	1662.4	21.2	1673	12.0	1687	3.4	1687	3.4
182	87819	3.9	9.7336	0.5	4.1763	1.1	0.2948	1.0	0.89	1665.6	14.5	1669	9.1	1674	9.4	1674	9.4

JFH-11-19C N34.73480 W119.39682

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
71	66295	1.9	12.4045	2.1	2.1782	2.5	0.1960	1.2	0.51	1153.6	13.2	1174	17.1	1212	41.7	1212	41.7
291	241419	1.2	12.4151	0.3	2.2029	0.7	0.1984	0.6	0.92	1166.5	6.9	1182	4.9	1210	5.5	1210	5.5
246	38732	0.7	23.5001	9.6	0.1410	9.8	0.0240	1.8	0.19	153.0	2.8	134	12.3	-194	240.6	153	2.8
1664	2348256	13.5	9.5961	0.1	4.0344	0.8	0.2808	0.8	0.99	1595.3	11.7	1641	6.8	1700	2.1	1700	2.1
563	669846	4.3	9.6648	0.2	3.9836	1.7	0.2792	1.7	0.99	1587.5	23.6	1631	13.7	1687	3.3	1687	3.3
139	26145	2.3	19.6395	11.9	0.2360	12.7	0.0336	4.3	0.34	213.1	9.0	215	24.6	237	276.3	213	9.0
24	27222	1.4	12.8161	8.7	2.0881	9.0	0.1941	2.1	0.24	1143.5	22.2	1145	61.5	1148	173.1	1148	173.1
132	33786	1.6	22.2873	13.2	0.2046	14.0	0.0331	4.8	0.34	209.7	9.8	189	24.2	-63	322.8	210	9.8
184	282034	3.4	9.6898	0.6	4.1147	1.7	0.2892	1.6	0.93	1637.4	22.9	1657	13.9	1682	11.3	1682	11.3
146	327479	2.1	9.3046	0.8	4.6794	3.4	0.3158	3.3	0.98	1769.1	51.5	1764	28.5	1757	13.7	1757	13.7
350	48110	1.3	19.4592	2.3	0.2717	3.9	0.0383	3.1	0.81	242.6	7.5	244	8.4	258	52.5	243	7.5
1004	836750	2.6	8.3423	0.2	5.7024	2.0	0.3450	2.0	0.99	1910.8	32.5	1932	17.1	1954	4.1	1954	4.1
26	3029	1.3	23.7879	316.1	0.1292	316.5	0.0223	14.8	0.05	142.1	20.8	123	385.1	-224	0.0	142	20.8
598	232045	12.1	9.6901	0.1	3.1353	1.2	0.2203	1.2	0.99	1283.7	13.9	1441	9.3	1682	2.6	1682	2.6
130	129804	2.3	9.8301	0.8	4.0552	2.2	0.2891	2.1	0.93	1637.1	30.3	1645	18.3	1656	15.1	1656	15.1
610	839912	14.3	6.4618	4.1	6.5432	7.6	0.3066	6.4	0.84	1724.2	96.4	2052	66.9	2399	69.9	2399	69.9
192	508484	3.1	9.7099	0.8	4.1361	1.3	0.2913	1.0	0.76	1647.9	14.1	1661	10.4	1679	15.4	1679	15.4
61	306133	2.1	10.2414	1.8	3.6231	2.4	0.2691	1.5	0.63	1536.3	20.3	1555	18.7	1580	34.1	1580	34.1
482	83469	9.9	19.5063	3.9	0.2859	4.1	0.0404	1.4	0.33	255.6	3.4	255	9.2	253	88.8	256	3.4
162	9449	1.0	21.0233	30.1	0.0833	30.4	0.0127	4.0	0.13	81.3	3.2	81	23.7	78	729.6	81	3.2
106	76249	0.6	11.1622	1.2	2.9731	1.4	0.2407	0.8	0.56	1390.3	10.1	1401	10.9	1417	22.7	1417	22.7
209	21130	1.3	20.0848	4.8	0.2356	5.1	0.0343	1.9	0.38	217.5	4.1	215	9.9	185	110.8	217	4.1
387	825971	7.4	11.1835	0.4	2.7763	0.9	0.2252	0.8	0.87	1309.2	9.0	1349	6.5	1413	8.2	1413	8.2
300	40685	1.1	20.4069	4.6	0.2340	4.8	0.0346	1.5	0.32	219.5	3.3	213	9.3	148	107.2	219	3.3
65	3088	1.0	-5.5576	537.6	-0.3346	537.8	0.0135	13.8	0.03	86.4	11.9	-414	#NUM!	NA	NA	86	11.9
16	16098	1.1	12.4940	9.4	2.2477	10.2	0.2037	4.0	0.40	1195.0	44.1	1196	71.8	1198	184.9	1198	184.9
137	382061	2.1	9.6516	0.9	4.2634	1.2	0.2984	0.8	0.66	1683.6	11.8	1686	9.9	1690	16.6	1690	16.6
32	43749	1.7	12.6355	6.7	2.1710	7.4	0.1990	3.1	0.42	1169.7	33.0	1172	51.2	1176	132.3	1176	132.3
134	128921	1.6	12.3823	1.4	2.2435	1.5	0.2015	0.4	0.24	1183.3	3.8	1195	10.3	1216	27.9	1216	27.9
46	43840	1.2	12.3951	2.8	2.2479	3.1	0.2021	1.3	0.43	1186.5	14.1	1196	21.5	1214	54.4	1214	54.4
55	4623	0.9	23.5190	57.9	0.1391	58.3	0.0237	7.2	0.12	151.2	10.8	132	72.5	-196	1572.4	151	10.8
242	356146	0.7	11.2736	0.7	2.3751	2.3	0.1942	2.2	0.95	1144.1	22.6	1235	16.2	1398	13.1	1398	13.1

37	31565	1.7	12.7382	2.5	2.2081	3.0	0.2040	1.7	0.57	1196.8	18.8	1184	21.2	1160	49.5	1160	49.5
325	283496	4.1	11.1708	0.5	3.0607	1.5	0.2480	1.4	0.94	1428.0	18.1	1423	11.5	1415	9.7	1415	9.7
55	1977	1.1	10.9272	98.3	0.1584	98.8	0.0126	10.7	0.11	80.4	8.5	149	138.1	1457	#VALUE!	80	8.5
54	39907	0.9	12.2075	3.3	2.3112	3.6	0.2046	1.4	0.38	1200.2	15.0	1216	25.4	1244	64.8	1244	64.8
35	4844	1.3	20.4665	56.1	0.1591	57.1	0.0236	10.6	0.19	150.5	15.8	150	79.8	141	1427.0	150	15.8
324	316476	11.3	11.1563	0.3	2.9956	1.9	0.2424	1.9	0.99	1399.1	23.9	1406	14.7	1418	6.3	1418	6.3
136	55619	1.4	18.8538	7.7	0.2749	8.0	0.0376	2.2	0.27	237.8	5.1	247	17.5	330	174.8	238	5.1
86	21943	0.5	24.4357	25.2	0.1357	25.8	0.0240	5.2	0.20	153.2	7.8	129	31.3	-292	652.7	153	7.8
61	130835	3.9	9.8170	1.3	4.0647	1.6	0.2894	1.0	0.60	1638.5	14.0	1647	13.2	1658	24.0	1658	24.0
32	34885	1.2	12.7439	5.4	2.1743	5.5	0.2010	1.3	0.23	1180.5	13.7	1173	38.5	1159	107.0	1159	107.0

JFH-11-20C N34.85316 W119.26884

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
67	34856	1.5	12.4437	2.1	2.2479	2.3	0.2029	1.0	0.44	1190.7	11.1	1196	16.1	1206	40.5	1206	40.5
122	56956	1.4	12.3809	1.1	2.1963	1.3	0.1972	0.6	0.50	1160.4	6.9	1180	9.1	1216	22.2	1216	22.2
38	16357	1.3	12.3605	2.5	2.2299	2.7	0.1999	1.0	0.37	1174.8	10.8	1190	19.1	1219	49.6	1219	49.6
68	21237	1.9	12.5248	2.3	2.2254	3.0	0.2022	2.0	0.65	1186.9	21.3	1189	21.2	1193	45.3	1193	45.3
132	73000	1.4	12.4574	0.9	2.2821	1.6	0.2062	1.3	0.84	1208.5	14.7	1207	11.2	1204	16.9	1204	16.9
82	4129	2.0	24.8150	20.9	0.1290	21.5	0.0232	5.1	0.24	148.0	7.5	123	25.0	-332	542.1	148	7.5
139	56643	1.4	12.4520	1.8	2.2575	2.5	0.2039	1.8	0.72	1196.1	19.9	1199	17.8	1205	34.6	1205	34.6
51	44712	1.0	12.5858	2.0	2.1786	2.7	0.1989	1.8	0.66	1169.2	19.1	1174	18.8	1183	40.1	1183	40.1
46	23753	1.3	12.3443	3.0	2.2199	3.6	0.1987	2.0	0.55	1168.6	21.5	1187	25.5	1222	59.6	1222	59.6
105	91186	1.0	12.3661	1.7	2.2055	1.9	0.1978	0.8	0.41	1163.5	8.2	1183	13.3	1218	34.2	1218	34.2
72	156945	2.8	10.4510	1.3	3.3204	2.1	0.2517	1.7	0.79	1447.1	21.9	1486	16.8	1542	24.9	1542	24.9
174	188981	1.6	12.3372	1.1	2.2236	1.4	0.1990	0.8	0.61	1169.8	8.8	1189	9.5	1223	21.2	1223	21.2
63	33260	2.6	12.6642	1.5	2.1553	1.9	0.1980	1.1	0.60	1164.4	12.2	1167	13.3	1171	30.6	1171	30.6
20	9842	1.3	12.2625	7.2	2.2686	7.4	0.2018	1.7	0.23	1184.8	18.0	1203	52.0	1235	141.1	1235	141.1
183	93918	4.2	12.4453	0.8	2.2561	2.1	0.2036	1.9	0.92	1194.9	20.7	1199	14.5	1206	16.2	1206	16.2
33	10093	1.0	12.4873	6.4	2.1984	6.6	0.1991	1.6	0.25	1170.5	17.7	1181	46.4	1199	127.1	1199	127.1
42	22556	1.2	12.5488	1.6	2.2094	2.8	0.2011	2.3	0.82	1181.1	25.0	1184	19.8	1189	32.4	1189	32.4
49	27088	1.4	12.7141	3.6	2.2438	4.0	0.2069	1.7	0.43	1212.3	18.7	1195	27.9	1163	71.2	1163	71.2
63	58358	1.0	12.5790	3.5	2.2061	3.6	0.2013	1.0	0.27	1182.1	10.6	1183	25.3	1185	68.8	1185	68.8
83	64989	1.0	12.4330	3.3	2.2870	3.5	0.2062	1.2	0.34	1208.7	13.0	1208	24.5	1208	64.3	1208	64.3
60	25917	1.9	12.5895	4.0	2.0345	4.3	0.1858	1.6	0.38	1098.4	16.2	1127	29.0	1183	78.2	1183	78.2
27	10219	1.1	12.1771	5.6	2.3115	6.1	0.2041	2.3	0.38	1197.5	25.4	1216	42.9	1248	109.5	1248	109.5
39	19647	1.3	12.3783	4.0	2.2581	4.3	0.2027	1.6	0.38	1189.9	17.6	1199	30.3	1216	78.5	1216	78.5
23	9869	1.5	12.6277	6.8	2.2105	7.4	0.2024	3.0	0.41	1188.4	33.1	1184	52.0	1177	134.1	1177	134.1
19	16004	1.9	12.4307	8.1	2.3013	8.5	0.2075	2.5	0.30	1215.3	28.0	1213	59.9	1208	159.0	1208	159.0
236	175396	1.5	12.4779	0.9	2.2787	1.4	0.2062	1.0	0.76	1208.7	11.4	1206	9.6	1200	17.4	1200	17.4
24	7855	1.3	12.2989	6.1	2.2992	6.3	0.2051	1.6	0.25	1202.6	17.0	1212	44.6	1229	119.9	1229	119.9
10	9042	1.9	12.6277	8.8	2.1863	10.0	0.2002	4.7	0.47	1176.6	50.4	1177	69.7	1177	174.9	1177	174.9
78	34419	1.0	12.5589	1.3	2.2309	1.5	0.2032	0.8	0.53	1192.5	8.8	1191	10.6	1188	25.4	1188	25.4
49	37786	1.5	12.6755	3.6	2.2112	4.1	0.2033	1.8	0.45	1192.9	19.9	1185	28.3	1169	71.6	1169	71.6
63	23001	1.2	12.2547	2.1	2.3308	2.3	0.2072	0.9	0.41	1213.7	10.4	1222	16.2	1236	40.8	1236	40.8
89	45124	1.6	12.6345	2.0	2.2365	2.2	0.2049	0.8	0.38	1201.8	9.2	1193	15.4	1176	40.1	1176	40.1

JFH-11-22C N34.83845 W119.35705

U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
53	100205	1.6	12.2844	3.2	2.3024	3.3	0.2051	0.8	0.25	1202.8	8.9	1213	23.3	1231	62.5	1231	62.5

138	313996	1.8	9.7148	0.7	4.2122	1.0	0.2968	0.7	0.72	1675.3	10.2	1676	7.9	1678	12.4	1678	12.4
362	793296	1.2	12.4223	0.5	2.2521	0.8	0.2029	0.7	0.82	1190.9	7.4	1197	5.8	1209	9.2	1209	9.2
97	921	0.3	11.4538	5.6	0.4455	6.1	0.0370	2.4	0.39	234.3	5.5	374	19.2	1367	108.7	234	5.5
679	1481899	1.2	9.5111	0.4	4.4010	1.5	0.3036	1.4	0.97	1709.1	21.4	1713	12.2	1717	6.8	1717	6.8
32	48411	1.5	12.0731	3.8	2.3339	4.0	0.2044	1.2	0.29	1198.7	12.6	1223	28.4	1265	74.7	1265	74.7
137	497961	1.3	9.6461	1.3	4.2839	1.4	0.2997	0.5	0.39	1689.8	8.0	1690	11.3	1691	23.3	1691	23.3
86	111531	1.0	12.4270	2.2	2.2185	2.5	0.1999	1.3	0.53	1175.0	14.4	1187	17.7	1209	42.4	1209	42.4
18	28596	1.3	11.9176	8.5	2.3408	8.8	0.2023	2.3	0.26	1187.8	24.9	1225	62.6	1290	165.4	1290	165.4
86	212159	2.2	12.4220	1.2	2.2222	1.7	0.2002	1.1	0.68	1176.4	12.3	1188	11.8	1209	24.3	1209	24.3
175	350463	1.9	9.7674	0.4	4.1108	1.0	0.2912	1.0	0.93	1647.6	14.1	1656	8.5	1668	7.3	1668	7.3
41	64873	1.0	12.3771	1.9	2.2905	2.4	0.2056	1.4	0.60	1205.4	15.5	1209	16.7	1216	37.2	1216	37.2
102	367832	1.7	9.6739	1.1	4.2792	2.9	0.3002	2.7	0.93	1692.5	39.9	1689	23.7	1685	19.7	1685	19.7
35	59307	1.8	12.8855	6.3	2.1364	6.5	0.1997	1.3	0.20	1173.5	14.2	1161	44.9	1137	126.5	1137	126.5
42	65704	2.8	11.6603	2.7	2.6172	3.2	0.2213	1.7	0.52	1288.9	19.3	1305	23.3	1333	52.3	1333	52.3
103	183527	1.4	12.5486	2.0	2.2605	2.4	0.2057	1.2	0.50	1206.0	13.0	1200	16.6	1189	40.3	1189	40.3
30	51596	0.9	12.2821	2.5	2.2819	3.3	0.2033	2.1	0.64	1192.9	23.3	1207	23.5	1232	50.0	1232	50.0
93	171363	1.9	12.6554	1.7	2.1847	1.9	0.2005	0.8	0.45	1178.1	8.9	1176	12.9	1173	32.8	1173	32.8
83	844	0.2	11.4361	6.0	0.4596	6.7	0.0381	3.1	0.46	241.2	7.4	384	21.5	1370	114.8	241	7.4
121	237272	1.9	9.6884	0.6	4.2166	1.2	0.2963	1.0	0.87	1672.9	15.4	1677	9.9	1683	11.1	1683	11.1
217	713640	3.3	9.6698	0.4	4.1750	3.5	0.2928	3.4	0.99	1655.5	50.2	1669	28.3	1686	6.8	1686	6.8
253	621	0.5	9.8436	9.3	0.1752	10.2	0.0125	4.2	0.41	80.1	3.3	164	15.4	1653	172.0	80	3.3
312	8155	2.2	36.7394	56.1	0.0141	56.7	0.0038	8.0	0.14	24.2	1.9	14	8.0	NA	NA	24	1.9
38	28164	1.1	12.6263	3.7	2.2489	3.9	0.2059	1.4	0.35	1207.2	15.2	1196	27.7	1177	73.0	1177	73.0
47	97201	1.2	12.3774	2.7	2.3127	3.1	0.2076	1.4	0.46	1216.1	15.7	1216	21.9	1216	54.0	1216	54.0
50	130114	1.0	12.3676	3.5	2.3079	3.7	0.2070	0.9	0.24	1212.9	9.8	1215	25.9	1218	69.8	1218	69.8
107	236967	0.9	9.7909	0.8	4.0547	1.2	0.2879	0.8	0.72	1631.1	12.1	1645	9.5	1663	15.0	1663	15.0
308	461441	1.1	11.2632	0.3	2.8858	1.4	0.2357	1.3	0.97	1364.5	16.1	1378	10.2	1399	6.7	1399	6.7
49	72873	1.2	12.2817	4.1	2.2930	4.4	0.2042	1.5	0.34	1198.1	16.3	1210	30.8	1232	80.4	1232	80.4
95	142311	0.9	12.4138	1.1	2.2465	1.7	0.2023	1.3	0.78	1187.4	14.3	1196	11.9	1211	20.7	1211	20.7
538	201492	1.4	20.0313	3.7	0.1787	4.0	0.0260	1.5	0.38	165.2	2.5	167	6.2	191	86.3	165	2.5
228	670603	2.1	9.6446	0.5	4.2156	1.1	0.2949	1.0	0.88	1665.8	14.5	1677	9.2	1691	9.7	1691	9.7
153	178638	2.5	12.5156	1.1	2.2645	1.8	0.2056	1.5	0.80	1205.1	16.0	1201	12.8	1195	21.7	1195	21.7
116	217440	1.0	12.3406	1.6	2.3152	2.0	0.2072	1.1	0.55	1214.0	11.9	1217	13.8	1222	32.0	1222	32.0
80	127673	1.5	12.5038	2.1	2.2177	2.5	0.2011	1.3	0.50	1181.3	13.5	1187	17.4	1196	42.3	1196	42.3
70	84177	1.1	12.2734	2.2	2.2512	2.5	0.2004	1.2	0.48	1177.4	13.1	1197	17.9	1233	43.8	1233	43.8
433	59647	1.5	9.6109	0.3	4.2996	0.9	0.2997	0.9	0.94	1689.8	13.2	1693	7.7	1698	5.8	1698	5.8
55	10629	0.8	23.4377	42.4	0.1387	42.7	0.0236	5.7	0.13	150.2	8.4	132	52.9	-187	1102.0	150	8.4
60	111034	1.0	12.6604	3.7	2.1747	4.0	0.1997	1.6	0.39	1173.6	16.9	1173	28.1	1172	73.7	1172	73.7
87	268736	1.7	12.4614	2.0	2.2298	2.2	0.2015	1.0	0.45	1183.5	10.8	1190	15.7	1203	39.6	1203	39.6
83	105079	2.3	12.5122	1.6	2.2262	1.8	0.2020	0.8	0.45	1186.2	8.6	1189	12.3	1195	30.8	1195	30.8
58	77838	2.1	12.4172	2.5	2.2950	2.6	0.2067	0.6	0.24	1211.1	6.8	1211	18.5	1210	50.0	1210	50.0
44	46153	1.4	12.5469	3.7	2.2433	3.8	0.2041	1.0	0.26	1197.5	10.8	1195	27.0	1190	73.4	1190	73.4
36	34874	1.5	12.2967	4.1	2.3301	4.3	0.2078	1.3	0.31	1217.1	14.7	1222	30.7	1229	80.7	1229	80.7
29	35270	1.6	12.6973	5.7	2.2466	5.9	0.2069	1.7	0.29	1212.2	18.8	1196	41.6	1166	112.4	1166	112.4
249	21682	0.5	21.3743	27.6	0.0778	27.8	0.0121	3.3	0.12	77.2	2.5	76	20.4	38	672.2	77	2.5
52	101166	2.2	12.7269	2.5	2.2117	2.6	0.2041	0.9	0.35	1197.6	10.0	1185	18.4	1161	49.0	1161	49.0

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U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±
(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)
234	33496	1.6	20.2123	6.0	0.2670	6.2	0.0391	1.7	0.27	247.5	4.1	240	13.4	170	140.3	247	4.1

153	13315	0.8	19.0217	12.3	0.1695	12.5	0.0234	1.9	0.15	149.0	2.8	159	18.3	310	281.0	149	2.8
56	8618	2.6	17.9497	18.8	0.3067	19.0	0.0399	2.5	0.13	252.4	6.2	272	45.3	441	422.6	252	6.2
67	4524	2.4	18.9812	50.6	0.1529	51.5	0.0210	9.7	0.19	134.3	12.8	144	69.5	315	1226.6	134	12.8
210	4257	1.5	29.7419	24.7	0.0576	25.6	0.0124	6.9	0.27	79.6	5.4	57	14.2	-822	711.3	80	5.4
323	11172	1.4	23.7871	18.5	0.0718	20.9	0.0124	9.7	0.46	79.3	7.6	70	14.2	-224	468.8	79	7.6
198	6482	1.5	21.2427	23.4	0.0847	23.6	0.0130	2.6	0.11	83.5	2.1	83	18.7	53	565.8	84	2.1
392	23183	2.4	21.4439	9.2	0.1070	9.3	0.0166	1.8	0.19	106.4	1.9	103	9.2	30	220.1	106	1.9
68	7302	1.3	20.2000	20.9	0.2671	21.2	0.0391	3.2	0.15	247.4	7.9	240	45.4	172	493.3	247	7.9
106	1811	1.4	39.9885	50.1	0.0437	50.4	0.0127	4.7	0.09	81.2	3.8	43	21.4	-1758	101.2	81	3.8
309	15694	2.1	21.1548	16.0	0.0771	16.3	0.0118	3.4	0.21	75.8	2.6	75	11.9	63	382.2	76	2.6
118	14422	1.1	24.4529	28.0	0.1361	29.1	0.0241	7.9	0.27	153.7	12.0	130	35.4	-294	726.9	154	12.0
41	2174	0.6	7.5854	130.1	0.2164	130.9	0.0119	15.2	0.12	76.3	11.5	199	240.9	2123	251.7	76	11.5
87	9871	1.7	18.2357	22.2	0.2948	22.4	0.0390	3.1	0.14	246.5	7.4	262	51.9	406	503.3	247	7.4
204	9103	1.3	21.1282	28.3	0.0836	28.5	0.0128	3.2	0.11	82.0	2.6	81	22.3	66	686.7	82	2.6
164	20175	3.1	19.6673	8.7	0.2704	8.8	0.0386	1.5	0.17	244.0	3.5	243	19.0	234	200.7	244	3.5
54	5105	1.8	23.9004	28.2	0.2184	29.8	0.0379	9.6	0.32	239.5	22.6	201	54.3	-236	724.0	240	22.6
214	79323	2.4	9.9041	0.8	3.1002	1.7	0.2227	1.5	0.87	1296.1	17.3	1433	13.0	1642	15.6	1642	15.6
84	13876	1.7	23.3324	21.2	0.2457	21.3	0.0416	2.3	0.11	262.6	5.9	223	42.6	-176	532.5	263	5.9
85	14639	3.5	19.6638	11.2	0.2694	11.3	0.0384	1.7	0.15	243.0	4.1	242	24.4	234	259.3	243	4.1
992	50900	1.7	20.1313	2.8	0.1638	2.9	0.0239	0.8	0.29	152.3	1.3	154	4.1	180	64.2	152	1.3
241	15797	1.7	20.7760	4.5	0.2661	4.7	0.0401	1.3	0.28	253.4	3.3	240	10.1	106	107.2	253	3.3
458	20383	1.2	21.2002	8.0	0.0839	8.5	0.0129	2.7	0.31	82.6	2.2	82	6.6	58	191.6	83	2.2
234	6554	2.2	19.2789	24.7	0.0878	24.9	0.0123	3.2	0.13	78.6	2.5	85	20.4	280	573.3	79	2.5
678	48718	0.3	20.8468	4.6	0.1554	4.6	0.0235	0.5	0.12	149.7	0.8	147	6.3	98	108.2	150	0.8
257	14087	2.1	20.9982	18.7	0.0803	18.9	0.0122	2.7	0.14	78.4	2.1	78	14.3	81	448.3	78	2.1
742	158459	21.0	9.6482	0.3	2.9964	4.1	0.2097	4.1	1.00	1227.1	46.0	1407	31.4	1690	6.1	1690	6.1
181	9757	1.6	20.9181	12.1	0.1562	12.2	0.0237	1.6	0.13	151.0	2.3	147	16.8	90	288.7	151	2.3
415	23605	1.3	19.5663	3.9	0.3027	4.4	0.0430	2.0	0.46	271.2	5.4	269	10.4	246	90.2	271	5.4
108	15410	2.1	22.1937	11.8	0.2425	12.1	0.0390	2.7	0.22	246.8	6.5	220	24.0	-53	288.5	247	6.5
71	12317	1.2	21.5785	15.2	0.2468	15.6	0.0386	3.7	0.24	244.3	9.0	224	31.4	15	366.6	244	9.0
323	9899	1.9	20.8406	13.2	0.0882	14.2	0.0133	5.2	0.37	85.4	4.4	86	11.7	98	313.7	85	4.4
287	8704	1.2	20.1415	20.6	0.0883	20.8	0.0129	2.2	0.11	82.6	1.8	86	17.1	179	485.5	83	1.8
347	11060	3.3	19.4613	7.9	0.1009	8.1	0.0142	1.8	0.22	91.2	1.6	98	7.5	258	180.9	91	1.6
53	2920	1.5	12.7376	117.3	0.1457	118.9	0.0135	19.5	0.16	86.2	16.7	138	154.8	1160	310.8	86	16.7
1163	89690	0.6	20.2299	2.1	0.1752	2.1	0.0257	0.6	0.28	163.6	1.0	164	3.2	168	48.1	164	1.0
276	5436	1.4	23.2632	14.1	0.0789	14.4	0.0133	2.9	0.20	85.3	2.5	77	10.7	-168	352.8	85	2.5
40	2951	0.8	11.0281	194.7	0.2952	195.1	0.0236	11.5	0.06	150.5	17.1	263	485.3	1440	541.0	150	17.1
123	17453	1.3	22.3850	29.0	0.2319	29.0	0.0377	2.1	0.07	238.3	5.0	212	55.6	-73	721.0	238	5.0
433	13255	2.4	23.4204	13.4	0.0705	13.6	0.0120	2.4	0.18	76.7	1.8	69	9.1	-185	335.5	77	1.8
127	3279	3.0	20.8324	30.0	0.0788	30.8	0.0119	7.0	0.23	76.3	5.3	77	22.8	99	723.2	76	5.3
209	46666	3.2	18.8686	6.0	0.3129	6.5	0.0428	2.5	0.38	270.3	6.6	276	15.6	329	135.4	270	6.6
57	2382	0.9	7.4358	218.8	0.2278	219.2	0.0123	14.0	0.06	78.7	10.9	208	438.2	2157	107.6	79	10.9
199	13093	1.4	20.2922	15.1	0.1576	15.5	0.0232	3.7	0.24	147.9	5.4	149	21.5	161	354.9	148	5.4

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