

## Appendix B. Hf isotopic data from the Chugach-Prince William terrane, Alaska.

### Analytical methods at the Arizona LaserChron Center

Hf isotope analyses are conducted with a Nu HR ICPMS connected to a New Wave UP193HE laser (2009-2010) or a Photon Machines Analyte G2 excimer laser (2011). Instrument settings are established first by analysis of 10 ppb solutions of JMC475 and a Spex Hf solution, and then by analysis of 10 ppb solutions containing Spex Hf, Yb, and Lu. The mixtures range in concentration of Yb and Lu, with  $^{176}\text{Yb} + ^{176}\text{Lu}$  up to 70% of the  $^{176}\text{Hf}$ . When all solutions yield  $^{176}\text{Hf}/^{177}\text{Hf}$  of  $\sim 0.28216$ , instrument settings are optimized for laser ablation analyses and seven different standard zircons (Mud Tank, 91500, Temora, R33, FC52, Plesovice, and Sri Lanka) are analyzed. These standards are included with unknowns on the same epoxy mounts. When precision and accuracy are acceptable, unknowns are analyzed using exactly the same acquisition parameters.

Laser ablation analyses are conducted with a laser beam diameter of 40 microns, with the ablation pits located on top of the U-Pb analysis pits. CL images are used to ensure that the ablation pits do not overlap multiple age domains or inclusions. Each acquisition consists of one 40-second integration on backgrounds (on peaks with no laser firing) followed by 60 one-second integrations with the laser firing. Using a typical laser fluence of  $\sim 5 \text{ J/cm}^2$  and pulse rate of 7 Hz, the ablation rate is  $\sim 0.8$  microns per second. Each standard is analyzed once for every  $\sim 20$  unknowns.

Isotope fractionation is accounted for using the method of Woodhead et al. (2004):  $\beta\text{Hf}$  is determined from the measured  $^{179}\text{Hf}/^{177}\text{Hf}$ ;  $\beta\text{Yb}$  is determined from the measured  $^{173}\text{Yb}/^{171}\text{Yb}$  (except for very low Yb signals);  $\beta\text{Lu}$  is assumed to be the same as  $\beta\text{Yb}$ ; and an exponential formula is used for fractionation correction. Yb and Lu interferences are corrected by measurement of  $^{176}\text{Yb}/^{171}\text{Yb}$  and  $^{176}\text{Lu}/^{175}\text{Lu}$  (respectively), as advocated by Woodhead et al. (2004). Critical isotope ratios are  $^{179}\text{Hf}/^{177}\text{Hf} = 0.73250$  (Patchett & Tatsumoto, 1980);  $^{173}\text{Yb}/^{171}\text{Yb} = 1.132338$  (Vervoort et al. 2004);  $^{176}\text{Yb}/^{171}\text{Yb} = 0.901691$  (Vervoort et al., 2004; Amelin and Davis, 2005);  $^{176}\text{Lu}/^{175}\text{Lu} = 0.02653$  (Patchett, 1983). All corrections are done line-by-line. For very low Yb signals,  $\beta\text{Hf}$  is used for fractionation of Yb isotopes. The corrected  $^{176}\text{Hf}/^{177}\text{Hf}$  values are filtered for outliers (2-sigma filter), and the average and standard error are calculated from the resulting  $\sim 58$  integrations. There is no capability to use only a portion of the acquired data.

All solutions, standards, and unknowns analyzed during a session are reduced together. The cutoff for using  $\beta\text{Hf}$  versus  $\beta\text{Yb}$  is determined by monitoring the average offset of the standards from their known values, and the cutoff is set at the minimum offset. For most data sets, this is achieved at  $\sim 6 \text{ mV}$  of  $^{171}\text{Yb}$ . For sessions in which the standards yield  $^{176}\text{Hf}/^{177}\text{Hf}$  values that are shifted consistently from the known values, a correction factor is applied to the  $^{176}\text{Hf}/^{177}\text{Hf}$  of all standards and unknowns. This correction factor, which is not necessary for most sessions, averages 1 epsilon unit.

The  $^{176}\text{Hf}/^{177}\text{Hf}$  at time of crystallization is calculated from measurement of present-day  $^{176}\text{Hf}/^{177}\text{Hf}$  and  $^{176}\text{Lu}/^{177}\text{Hf}$ , using the decay constant of  $^{176}\text{Lu}$  ( $\lambda = 1.867 \times 10^{-11}$ ) from Scherer et al. (2001) and Söderlund et al. (2004). No capability is provided for calculating Hf Depleted Mantle model ages because the  $^{176}\text{Hf}/^{177}\text{Hf}$  and  $^{176}\text{Lu}/^{177}\text{Hf}$  of the source material(s) from which the zircon crystallized is not known.

Notes for Table B:

1. Data reduction methodology is from Woodhead et al. (2004)
2. Analytical methods described in detail by Gehrels and Pecha (2014)
3.  $(^{176}\text{Yb} + ^{176}\text{Lu}) / ^{176}\text{Hf}$  (%) expresses the proportion of 176 due to  $^{176}\text{Yb} + ^{176}\text{Lu}$  versus the proportion due to  $^{176}\text{Hf}$ , in %.
4. Volts Hf is the sum of voltages of all Hf isotopes.
5.  $^{176}\text{Hf}/^{177}\text{Hf}$  is the measured  $^{176}\text{Hf}/^{177}\text{Hf}$ , corrected for fractionation and interferences. Shown with uncertainty expressed at 1-sigma.
6.  $^{176}\text{Lu}/^{177}\text{Hf}$  is the intensity of  $^{176}\text{Lu}$ , calculated from the measured intensity of  $^{175}\text{Lu}$  and  $^{176}\text{Lu}/^{175}\text{Lu} = 0.02653$  (from Patchett, 1983), compared to the measured intensity of  $^{177}\text{Hf}$ . Fractionation of Lu isotopes is assumed to be the same as fractionation of Yb isotopes.
7.  $^{176}\text{Hf}/^{177}\text{Hf}(\text{T})$  is the  $^{176}\text{Hf}/^{177}\text{Hf}$  corrected to the time of crystallization using a decay constant of  $1.867 \times 10^{-11}$  (from Scherer et al., 2001 and Soderland et al., 2004)
8. E-Hf (0) is the present-day epsilon Hf value using  $^{176}\text{Hf}/^{177}\text{Hf} = 0.282785$  and  $^{176}\text{Lu}/^{177}\text{Hf} = 0.0336$  (from Bouvier et al., 2008). The uncertainty is expressed at 1-sigma.
9. E-Hf (T) is the epsilon Hf value at the time of crystallization. The uncertainty is expressed at 1-sigma.

10. U-Pb ages are based on 206/238 for ages younger than ~1.0 Ga, and on 206/207 for ages older than ~1.0 Ga. This age cutoff may be slightly different for each sample.
11. Isotope ratios as follows:
  - 180/177 1.8866600 Patchett (1983)
  - 179/177 0.7325000 Patchett & Tatsumoto (1980)
  - 178/177 1.4671800 Patchett (1983)
  - 176/177 0.2821600 Patchett (1983)
  - 174/177 0.0087100 Patchett (1983)
  - 176/175 0.0265300 Patchett (1983)
  - 176/171 0.9016910 Vervoort et al. (2004)
  - 173/171 1.1323569 Vervoort et al. (2004)
  - 172/171 1.5317360 Vervoort et al. (2004)

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**Table B. Hf isotopic data from the Chugach-Prince William terrane, Alaska**

| Sample                                                       | $\left(\frac{^{176}\text{Yb} + ^{176}\text{Lu}}{^{176}\text{Hf}}\right)$<br>(%) | Volts<br>Hf | $\frac{^{176}\text{Hf}}{^{177}\text{Hf}}$ | $\pm (1\sigma)$ | $\frac{^{176}\text{Lu}}{^{177}\text{Hf}}$ | $\frac{^{176}\text{Hf}}{^{177}\text{Hf(t)}}$ | $\epsilon \text{ Hf (0)}$ | $\epsilon \text{ Hf (0)}$<br>$\pm (1\sigma)$ | $\epsilon \text{ Hf (t)}$ | Age<br>(Ma) |
|--------------------------------------------------------------|---------------------------------------------------------------------------------|-------------|-------------------------------------------|-----------------|-------------------------------------------|----------------------------------------------|---------------------------|----------------------------------------------|---------------------------|-------------|
| <b>Sample 11CD-60, Ghost Rocks Fm (57.43846, -152.73250)</b> |                                                                                 |             |                                           |                 |                                           |                                              |                           |                                              |                           |             |
| 11CD-60PC-86                                                 | 19.4                                                                            | 2.2         | 0.282165                                  | 0.000035        | 0.001063                                  | 0.282158                                     | -21.9                     | 1.3                                          | -13.9                     | 371         |
| 11CD-60PC-12                                                 | 22.8                                                                            | 2.6         | 0.282413                                  | 0.000044        | 0.001667                                  | 0.282398                                     | -13.1                     | 1.6                                          | -3.2                      | 472         |
| 11CD-60PC-50                                                 | 18.6                                                                            | 2.4         | 0.282184                                  | 0.000035        | 0.001049                                  | 0.282173                                     | -21.2                     | 1.2                                          | -9.1                      | 563         |
| 11CD-60PC-26                                                 | 36.0                                                                            | 2.1         | 0.281811                                  | 0.000040        | 0.001924                                  | 0.281788                                     | -34.4                     | 1.4                                          | -21.1                     | 637         |
| 11CD-60PC-07                                                 | 7.4                                                                             | 2.8         | 0.282135                                  | 0.000045        | 0.000551                                  | 0.282128                                     | -23.0                     | 1.6                                          | -8.9                      | 644         |
| 11CD-60PC-23                                                 | 19.3                                                                            | 2.2         | 0.282248                                  | 0.000036        | 0.001348                                  | 0.282231                                     | -19.0                     | 1.3                                          | -4.7                      | 667         |
| 11CD-60PC-02                                                 | 24.1                                                                            | 2.4         | 0.282477                                  | 0.000039        | 0.001197                                  | 0.282461                                     | -10.9                     | 1.4                                          | 4.5                       | 714         |
| 11CD-60PC-77                                                 | 31.7                                                                            | 2.0         | 0.282235                                  | 0.000046        | 0.001594                                  | 0.282205                                     | -19.5                     | 1.6                                          | 1.9                       | 1003        |
| 11CD-60PC-13                                                 | 10.9                                                                            | 2.4         | 0.282201                                  | 0.000040        | 0.000610                                  | 0.282189                                     | -20.6                     | 1.4                                          | 2.2                       | 1038        |
| 11CD-60PC-88                                                 | 16.4                                                                            | 1.4         | 0.282102                                  | 0.000059        | 0.000778                                  | 0.282087                                     | -24.2                     | 2.1                                          | -1.3                      | 1046        |
| 11CD-60PC-59                                                 | 12.1                                                                            | 1.7         | 0.281933                                  | 0.000051        | 0.000777                                  | 0.281914                                     | -30.1                     | 1.8                                          | -2.6                      | 1258        |
| 11CD-60PC-46                                                 | 13.5                                                                            | 2.0         | 0.282226                                  | 0.000034        | 0.000786                                  | 0.282207                                     | -19.8                     | 1.2                                          | 8.1                       | 1270        |
| 11CD-60PC-04                                                 | 31.5                                                                            | 2.1         | 0.282031                                  | 0.000047        | 0.001948                                  | 0.281982                                     | -26.7                     | 1.7                                          | 1.7                       | 1342        |
| 11CD-60PC-98                                                 | 9.2                                                                             | 2.0         | 0.282092                                  | 0.000051        | 0.000611                                  | 0.282076                                     | -24.5                     | 1.8                                          | 5.4                       | 1354        |
| 11CD-60PC-29                                                 | 10.4                                                                            | 2.2         | 0.281881                                  | 0.000045        | 0.000722                                  | 0.281861                                     | -32.0                     | 1.6                                          | -0.6                      | 1426        |
| 11CD-60PC-90                                                 | 28.5                                                                            | 1.1         | 0.282291                                  | 0.000071        | 0.001819                                  | 0.282241                                     | -17.5                     | 2.5                                          | 13.9                      | 1473        |
| 11CD-60PC-63                                                 | 15.4                                                                            | 2.3         | 0.282130                                  | 0.000048        | 0.000856                                  | 0.282105                                     | -23.2                     | 1.7                                          | 10.0                      | 1512        |
| 11CD-60PC-09                                                 | 14.0                                                                            | 2.3         | 0.281964                                  | 0.000039        | 0.000852                                  | 0.281940                                     | -29.0                     | 1.4                                          | 4.3                       | 1521        |
| 11CD-60PC-76                                                 | 14.8                                                                            | 1.8         | 0.281831                                  | 0.000069        | 0.000782                                  | 0.281807                                     | -33.7                     | 2.5                                          | 2.4                       | 1642        |
| 11CD-60PC-74                                                 | 22.0                                                                            | 2.4         | 0.281912                                  | 0.000041        | 0.001300                                  | 0.281872                                     | -30.9                     | 1.5                                          | 4.9                       | 1652        |
| 11CD-60PC-39                                                 | 20.9                                                                            | 2.2         | 0.281363                                  | 0.000033        | 0.001100                                  | 0.281327                                     | -50.3                     | 1.2                                          | -12.8                     | 1720        |
| 11CD-60PC-24                                                 | 8.8                                                                             | 2.1         | 0.281804                                  | 0.000048        | 0.000518                                  | 0.281787                                     | -34.7                     | 1.7                                          | 4.1                       | 1745        |
| 11CD-60PC-99                                                 | 7.9                                                                             | 2.4         | 0.281384                                  | 0.000043        | 0.000437                                  | 0.281369                                     | -49.5                     | 1.5                                          | -8.7                      | 1836        |
| 11CD-60PC-01                                                 | 3.8                                                                             | 2.3         | 0.281539                                  | 0.000042        | 0.000201                                  | 0.281531                                     | -44.1                     | 1.5                                          | -1.0                      | 1920        |
| 11CD-60PC-95                                                 | 10.7                                                                            | 1.2         | 0.280946                                  | 0.000050        | 0.000738                                  | 0.280918                                     | -65.0                     | 1.8                                          | -20.7                     | 2008        |
| 11CD-60PC-17                                                 | 2.8                                                                             | 2.2         | 0.281354                                  | 0.000041        | 0.000166                                  | 0.281348                                     | -50.6                     | 1.4                                          | -4.9                      | 2032        |
| 11CD-60PC-73                                                 | 24.2                                                                            | 2.3         | 0.281625                                  | 0.000033        | 0.001535                                  | 0.281563                                     | -41.0                     | 1.2                                          | 4.7                       | 2118        |
| 11CD-60PC-100                                                | 12.1                                                                            | 2.8         | 0.281341                                  | 0.000049        | 0.000732                                  | 0.281309                                     | -51.0                     | 1.7                                          | 0.2                       | 2312        |
| 11CD-60PC-33                                                 | 10.2                                                                            | 2.1         | 0.281056                                  | 0.000040        | 0.000564                                  | 0.281029                                     | -61.1                     | 1.4                                          | -3.7                      | 2571        |
| 11CD-60PC-94                                                 | 15.2                                                                            | 2.3         | 0.281097                                  | 0.000037        | 0.000909                                  | 0.281049                                     | -59.7                     | 1.3                                          | 0.5                       | 2721        |
| 11CD-60PC-20                                                 | 6.1                                                                             | 2.0         | 0.281025                                  | 0.000040        | 0.000379                                  | 0.281004                                     | -62.3                     | 1.4                                          | 0.9                       | 2805        |
| 11CD-60PC-92                                                 | 11.7                                                                            | 1.9         | 0.280805                                  | 0.000039        | 0.000735                                  | 0.280765                                     | -70.0                     | 1.4                                          | -6.6                      | 2846        |
| <b>Sample 11HW-23, Orca Fm (60.5510, -148.4158)</b>          |                                                                                 |             |                                           |                 |                                           |                                              |                           |                                              |                           |             |
| 11HW-23-PC-77                                                | 5.8                                                                             | 2.4         | 0.282566                                  | 0.000044        | 0.000402                                  | 0.282563                                     | -7.7                      | 1.5                                          | 0.6                       | 379         |
| 11HW-23-PC-29                                                | 26.2                                                                            | 2.8         | 0.282356                                  | 0.000030        | 0.001524                                  | 0.282344                                     | -15.2                     | 1.1                                          | -6.4                      | 414         |
| 11HW-23-PC-63                                                | 35.1                                                                            | 3.2         | 0.282432                                  | 0.000032        | 0.001881                                  | 0.282417                                     | -12.5                     | 1.1                                          | -3.6                      | 423         |
| 11HW-23-PC-30                                                | 1.6                                                                             | 3.4         | 0.282313                                  | 0.000036        | 0.000087                                  | 0.282313                                     | -16.7                     | 1.3                                          | -7.2                      | 429         |
| 11HW-23-PC-13                                                | 14.1                                                                            | 2.6         | 0.282533                                  | 0.000041        | 0.001833                                  | 0.282517                                     | -8.9                      | 1.5                                          | 0.6                       | 453         |
| 11HW-23-PC-95                                                | 13.4                                                                            | 2.4         | 0.282211                                  | 0.000035        | 0.000985                                  | 0.282202                                     | -20.3                     | 1.3                                          | -9.5                      | 500         |
| 11HW-23-PC-94                                                | 18.0                                                                            | 2.5         | 0.282751                                  | 0.000033        | 0.001217                                  | 0.282738                                     | -1.2                      | 1.2                                          | 11.0                      | 566         |
| 11HW-23-PC-54                                                | 14.4                                                                            | 3.2         | 0.282439                                  | 0.000035        | 0.001053                                  | 0.282426                                     | -12.3                     | 1.2                                          | 1.4                       | 630         |
| 11HW-23-PC-67                                                | 17.0                                                                            | 3.6         | 0.282339                                  | 0.000031        | 0.001079                                  | 0.282325                                     | -15.8                     | 1.1                                          | -0.6                      | 702         |
| 11HW-23-PC-05                                                | 29.1                                                                            | 2.5         | 0.282555                                  | 0.000040        | 0.002244                                  | 0.282520                                     | -8.1                      | 1.4                                          | 9.1                       | 826         |
| 11HW-23-PC-39                                                | 4.9                                                                             | 3.0         | 0.282265                                  | 0.000034        | 0.000276                                  | 0.282260                                     | -18.4                     | 1.2                                          | 4.6                       | 1033        |
| 11HW-23-PC-08                                                | 4.5                                                                             | 3.4         | 0.282150                                  | 0.000037        | 0.000273                                  | 0.282145                                     | -22.4                     | 1.3                                          | 1.2                       | 1062        |
| 11HW-23-PC-60                                                | 22.9                                                                            | 2.2         | 0.282240                                  | 0.000032        | 0.001292                                  | 0.282212                                     | -19.3                     | 1.1                                          | 5.7                       | 1156        |
| 11HW-23-PC-88                                                | 10.1                                                                            | 3.8         | 0.282098                                  | 0.000035        | 0.000498                                  | 0.282087                                     | -24.3                     | 1.2                                          | 1.3                       | 1160        |
| 11HW-23-PC-02                                                | 23.9                                                                            | 2.7         | 0.281840                                  | 0.000041        | 0.001355                                  | 0.281805                                     | -33.4                     | 1.5                                          | -4.2                      | 1355        |
| 11HW-23-PC-69                                                | 11.3                                                                            | 3.0         | 0.282188                                  | 0.000032        | 0.000657                                  | 0.282171                                     | -21.1                     | 1.1                                          | 9.0                       | 1366        |
| 11HW-23-PC-74                                                | 18.0                                                                            | 3.8         | 0.282045                                  | 0.000031        | 0.001162                                  | 0.282014                                     | -26.2                     | 1.1                                          | 4.5                       | 1412        |
| 11HW-23-PC-52                                                | 6.7                                                                             | 2.7         | 0.281938                                  | 0.000029        | 0.000432                                  | 0.281925                                     | -30.0                     | 1.0                                          | 3.9                       | 1523        |
| 11HW-23-PC-27                                                | 0.6                                                                             | 2.8         | 0.281927                                  | 0.000036        | 0.000029                                  | 0.281926                                     | -30.4                     | 1.3                                          | 4.1                       | 1534        |
| 11HW-23-PC-31                                                | 12.2                                                                            | 2.8         | 0.281449                                  | 0.000041        | 0.000645                                  | 0.281428                                     | -47.2                     | 1.4                                          | -8.0                      | 1773        |
| 11HW-23-PC-80                                                | 12.3                                                                            | 3.0         | 0.281554                                  | 0.000029        | 0.000793                                  | 0.281527                                     | -43.5                     | 1.0                                          | -4.4                      | 1776        |
| 11HW-23-PC-58                                                | 10.0                                                                            | 2.4         | 0.281560                                  | 0.000039        | 0.000551                                  | 0.281541                                     | -43.3                     | 1.4                                          | -3.7                      | 1788        |
| 11HW-23-PC-61                                                | 13.5                                                                            | 3.1         | 0.281657                                  | 0.000034        | 0.000766                                  | 0.281631                                     | -39.9                     | 1.2                                          | -0.4                      | 1789        |

| Sample         | $(\frac{^{176}\text{Yb} + ^{176}\text{Lu}}{^{176}\text{Hf}})$<br>(%) | Volts<br>Hf | $\frac{^{176}\text{Hf}}{^{177}\text{Hf}}$ | $\pm (1\sigma)$ | $\frac{^{176}\text{Lu}}{^{177}\text{Hf}}$ | $\frac{^{176}\text{Hf}}{^{177}\text{Hf}(t)}$ | $\epsilon \text{ Hf (0)}$ | $\epsilon \text{ Hf (0)}$<br>$\pm (1\sigma)$ | $\epsilon \text{ Hf (t)}$ | Age<br>(Ma) |
|----------------|----------------------------------------------------------------------|-------------|-------------------------------------------|-----------------|-------------------------------------------|----------------------------------------------|---------------------------|----------------------------------------------|---------------------------|-------------|
| 11HW-23-PC-36  | 7.2                                                                  | 2.9         | 0.281616                                  | 0.000036        | 0.000400                                  | 0.281602                                     | -41.3                     | 1.3                                          | 0.0                       | 1855        |
| 11HW-23-PC-44  | 14.3                                                                 | 2.4         | 0.281742                                  | 0.000040        | 0.000783                                  | 0.281714                                     | -36.9                     | 1.4                                          | 4.7                       | 1885        |
| 11HW-23-PC-100 | 7.3                                                                  | 3.0         | 0.281045                                  | 0.000033        | 0.000386                                  | 0.281031                                     | -61.5                     | 1.2                                          | -19.0                     | 1906        |
| 11HW-23-PC-50  | 3.7                                                                  | 2.9         | 0.281148                                  | 0.000041        | 0.000220                                  | 0.281139                                     | -57.9                     | 1.4                                          | -5.5                      | 2326        |
| 11HW-23-PC-53  | 10.0                                                                 | 2.6         | 0.281107                                  | 0.000041        | 0.000541                                  | 0.281080                                     | -59.4                     | 1.4                                          | -2.8                      | 2533        |
| 11HW-23-PC-11  | 41.2                                                                 | 2.7         | 0.281192                                  | 0.000043        | 0.002173                                  | 0.281086                                     | -56.3                     | 1.5                                          | -2.1                      | 2550        |
| 11HW-23-PC-48  | 5.4                                                                  | 2.9         | 0.281171                                  | 0.000033        | 0.000327                                  | 0.281155                                     | -57.1                     | 1.2                                          | 2.2                       | 2632        |
| 11HW-23-PC-15  | 7.5                                                                  | 2.7         | 0.280905                                  | 0.000038        | 0.000509                                  | 0.280877                                     | -66.5                     | 1.3                                          | -0.6                      | 2935        |

**Sample 11SJO-34, Sitkalidak Fm (57.42846, -152.32520)**

|              |      |     |          |          |          |          |       |     |       |      |
|--------------|------|-----|----------|----------|----------|----------|-------|-----|-------|------|
| 11SJ034PC-13 | 20.2 | 3.6 | 0.282398 | 0.000026 | 0.001330 | 0.282389 | -13.7 | 0.9 | -6.2  | 351  |
| 11SJ034PC-10 | 8.5  | 2.9 | 0.282516 | 0.000024 | 0.000633 | 0.282512 | -9.5  | 0.8 | -1.8  | 353  |
| 11SJ034PC-47 | 15.4 | 3.6 | 0.282583 | 0.000031 | 0.001059 | 0.282576 | -7.1  | 1.1 | 0.8   | 370  |
| 11SJ034PC-05 | 9.9  | 3.5 | 0.282370 | 0.000036 | 0.000578 | 0.282365 | -14.7 | 1.3 | -4.7  | 457  |
| 11SJ034PC-15 | 17.8 | 4.1 | 0.281988 | 0.000033 | 0.001057 | 0.281978 | -28.2 | 1.2 | -17.3 | 503  |
| 11SJO-34Y-12 | 3.0  | 1.7 | 0.281712 | 0.000054 | 0.000155 | 0.281710 | -38.0 | 1.9 | -25.7 | 553  |
| 11SJ034PC-37 | 16.7 | 2.9 | 0.282476 | 0.000031 | 0.001055 | 0.282464 | -10.9 | 1.1 | 2.4   | 618  |
| 11SJ034PC-06 | 15.5 | 3.6 | 0.282251 | 0.000033 | 0.000966 | 0.282233 | -18.9 | 1.2 | 2.3   | 975  |
| 11SJ034PC-23 | 10.5 | 3.9 | 0.282348 | 0.000027 | 0.000646 | 0.282335 | -15.5 | 0.9 | 6.4   | 997  |
| 11SJ034PC-29 | 7.1  | 4.2 | 0.282220 | 0.000028 | 0.000433 | 0.282212 | -20.0 | 1.0 | 2.4   | 1011 |
| 11SJ034PC-31 | 3.1  | 3.9 | 0.282291 | 0.000033 | 0.000171 | 0.282287 | -17.5 | 1.2 | 6.0   | 1052 |
| 11SJ034PC-03 | 28.9 | 2.7 | 0.282272 | 0.000038 | 0.001723 | 0.282237 | -18.2 | 1.3 | 4.6   | 1068 |
| 11SJ034PC-43 | 41.1 | 2.4 | 0.282372 | 0.000041 | 0.002535 | 0.282318 | -14.6 | 1.5 | 8.6   | 1120 |
| 11SJ034PC-46 | 10.9 | 4.1 | 0.282138 | 0.000031 | 0.000646 | 0.282124 | -22.9 | 1.1 | 2.8   | 1167 |
| 11SJ034PC-11 | 10.6 | 3.3 | 0.281869 | 0.000038 | 0.000603 | 0.281851 | -32.4 | 1.3 | 2.9   | 1597 |
| 11SJ034PC-25 | 13.6 | 3.8 | 0.282043 | 0.000038 | 0.000812 | 0.282018 | -26.2 | 1.3 | 9.2   | 1611 |
| 11SJ034PC-07 | 18.1 | 2.9 | 0.281540 | 0.000031 | 0.001187 | 0.281502 | -44.0 | 1.1 | -6.7  | 1719 |
| 11SJ034PC-14 | 10.8 | 3.0 | 0.281798 | 0.000030 | 0.000723 | 0.281773 | -34.9 | 1.1 | 4.9   | 1804 |
| 11SJ034PC-53 | 7.0  | 3.1 | 0.281408 | 0.000032 | 0.000406 | 0.281394 | -48.7 | 1.1 | -7.9  | 1833 |
| 11SJ034PC-33 | 11.6 | 3.8 | 0.281432 | 0.000034 | 0.000727 | 0.281405 | -47.8 | 1.2 | -4.6  | 1955 |
| 11SJ034PC-50 | 1.3  | 3.5 | 0.281383 | 0.000030 | 0.000142 | 0.281378 | -49.6 | 1.1 | -4.8  | 1988 |
| 11SJ034PC-35 | 4.7  | 3.9 | 0.281484 | 0.000027 | 0.000287 | 0.281473 | -46.0 | 0.9 | -1.2  | 2001 |
| 11SJ034PC-28 | 5.7  | 2.4 | 0.280969 | 0.000041 | 0.000302 | 0.280958 | -64.2 | 1.5 | -19.0 | 2024 |
| 11SJ034PC-27 | 18.9 | 3.0 | 0.281336 | 0.000040 | 0.001196 | 0.281284 | -51.2 | 1.4 | -0.6  | 2317 |
| 11SJO-34Y-31 | 13.5 | 2.0 | 0.281237 | 0.000038 | 0.000798 | 0.281200 | -54.7 | 1.4 | -1.5  | 2405 |
| 11SJ034PC-04 | 10.4 | 3.4 | 0.281125 | 0.000027 | 0.000594 | 0.281096 | -58.7 | 1.0 | -0.4  | 2609 |

**Sample JG10-25, Yakutat Fm (59.91939, -139.57452)**

|           |      |     |          |          |          |          |       |     |       |     |
|-----------|------|-----|----------|----------|----------|----------|-------|-----|-------|-----|
| JG1025-20 | 19.4 | 2.6 | 0.282884 | 0.000040 | 0.001182 | 0.282883 | 3.5   | 1.4 | 4.8   | 60  |
| JG1025-06 | 22.7 | 3.2 | 0.282855 | 0.000037 | 0.001350 | 0.282853 | 2.5   | 1.3 | 3.8   | 63  |
| JG1025-53 | 31.5 | 3.1 | 0.281993 | 0.000039 | 0.002000 | 0.281991 | -28.0 | 1.4 | -26.5 | 70  |
| JG1025-98 | 18.2 | 3.3 | 0.282260 | 0.000026 | 0.001031 | 0.282259 | -18.6 | 0.9 | -17.0 | 74  |
| JG1025-49 | 13.2 | 3.6 | 0.282990 | 0.000026 | 0.000851 | 0.282989 | 7.3   | 0.9 | 9.0   | 80  |
| JG1025-68 | 24.5 | 3.7 | 0.282385 | 0.000032 | 0.001529 | 0.282382 | -14.2 | 1.1 | -12.3 | 86  |
| JG1025-45 | 25.6 | 3.2 | 0.282956 | 0.000027 | 0.001444 | 0.282953 | 6.0   | 1.0 | 7.9   | 89  |
| JG1025-54 | 6.0  | 3.6 | 0.282379 | 0.000030 | 0.000428 | 0.282378 | -14.4 | 1.1 | -12.3 | 93  |
| JG1025-30 | 12.1 | 3.1 | 0.282766 | 0.000030 | 0.000728 | 0.282765 | -0.7  | 1.1 | 1.4   | 97  |
| JG1025-27 | 24.1 | 3.2 | 0.282211 | 0.000036 | 0.001458 | 0.282208 | -20.3 | 1.3 | -18.0 | 109 |
| JG1025-14 | 19.1 | 3.2 | 0.283019 | 0.000032 | 0.001093 | 0.283016 | 8.3   | 1.1 | 11.3  | 142 |
| JG1025-32 | 14.7 | 3.1 | 0.283033 | 0.000029 | 0.001022 | 0.283030 | 8.8   | 1.0 | 11.9  | 147 |
| JG1025-17 | 16.2 | 3.3 | 0.282916 | 0.000029 | 0.001019 | 0.282913 | 4.6   | 1.0 | 8.0   | 154 |
| JG1025-07 | 16.7 | 2.9 | 0.282721 | 0.000033 | 0.001035 | 0.282718 | -2.3  | 1.2 | 1.3   | 164 |
| JG1025-39 | 13.4 | 2.8 | 0.282940 | 0.000024 | 0.000789 | 0.282937 | 5.5   | 0.9 | 9.3   | 175 |
| JG1025-05 | 21.4 | 3.1 | 0.282903 | 0.000036 | 0.001310 | 0.282899 | 4.2   | 1.3 | 7.9   | 176 |
| JG1025-97 | 48.6 | 2.7 | 0.282907 | 0.000035 | 0.002983 | 0.282897 | 4.3   | 1.2 | 8.0   | 182 |
| JG1025-44 | 10.0 | 3.4 | 0.282894 | 0.000034 | 0.000593 | 0.282892 | 3.8   | 1.2 | 7.9   | 187 |
| JG1025-22 | 20.5 | 2.9 | 0.282985 | 0.000030 | 0.001203 | 0.282980 | 7.1   | 1.1 | 11.2  | 192 |
| JG1025-96 | 11.6 | 3.4 | 0.282984 | 0.000033 | 0.000730 | 0.282981 | 7.0   | 1.2 | 11.3  | 198 |

| Sample        | $(\frac{^{176}\text{Yb} + ^{176}\text{Lu}}{^{176}\text{Hf}})$<br>(%) | Volts<br>Hf | $\frac{^{176}\text{Hf}}{^{177}\text{Hf}}$ | $\pm (1\sigma)$ | $\frac{^{176}\text{Lu}}{^{177}\text{Hf}}$ | $\frac{^{176}\text{Hf}}{^{177}\text{Hf}(t)}$ | $\epsilon \text{ Hf (0)}$ | $\epsilon \text{ Hf (0)}$<br>$\pm (1\sigma)$ | $\epsilon \text{ Hf (t)}$ | Age<br>(Ma) |
|---------------|----------------------------------------------------------------------|-------------|-------------------------------------------|-----------------|-------------------------------------------|----------------------------------------------|---------------------------|----------------------------------------------|---------------------------|-------------|
| JG 10-25PC-76 | 29.8                                                                 | 2.4         | 0.282920                                  | 0.000043        | 0.002074                                  | 0.282911                                     | 4.8                       | 1.5                                          | 9.9                       | 245         |
| JG1025-21     | 28.2                                                                 | 2.2         | 0.282441                                  | 0.000048        | 0.001570                                  | 0.282433                                     | -12.2                     | 1.7                                          | -7.0                      | 246         |
| JG1025-09     | 20.0                                                                 | 3.8         | 0.282577                                  | 0.000045        | 0.001269                                  | 0.282569                                     | -7.3                      | 1.6                                          | 0.6                       | 371         |
| JG1025-50     | 12.2                                                                 | 1.9         | 0.282418                                  | 0.000031        | 0.000749                                  | 0.282412                                     | -13.0                     | 1.1                                          | -3.1                      | 455         |
| JG 10-25PC-51 | 19.0                                                                 | 2.9         | 0.282180                                  | 0.000030        | 0.001038                                  | 0.282160                                     | -21.4                     | 1.1                                          | 1.3                       | 1047        |
| JG 10-25PC-53 | 19.7                                                                 | 3.4         | 0.282215                                  | 0.000035        | 0.001075                                  | 0.282192                                     | -20.1                     | 1.2                                          | 5.2                       | 1166        |
| JG1025-16     | 41.1                                                                 | 3.0         | 0.282058                                  | 0.000034        | 0.002349                                  | 0.281997                                     | -25.7                     | 1.2                                          | 2.9                       | 1369        |
| JG1025-51     | 30.6                                                                 | 4.2         | 0.281903                                  | 0.000025        | 0.001745                                  | 0.281858                                     | -31.2                     | 0.9                                          | -1.9                      | 1374        |
| JG 10-25PC-56 | 20.4                                                                 | 3.1         | 0.282125                                  | 0.000040        | 0.001340                                  | 0.282090                                     | -23.3                     | 1.4                                          | 6.4                       | 1376        |
| JG 10-25PC-65 | 39.3                                                                 | 4.7         | 0.281868                                  | 0.000034        | 0.002130                                  | 0.281812                                     | -32.4                     | 1.2                                          | -3.4                      | 1378        |
| JG 10-25PC-04 | 30.0                                                                 | 3.6         | 0.281980                                  | 0.000027        | 0.001663                                  | 0.281937                                     | -28.5                     | 1.0                                          | 1.0                       | 1378        |
| JG 10-25PC-73 | 31.8                                                                 | 3.6         | 0.282035                                  | 0.000039        | 0.001888                                  | 0.281985                                     | -26.5                     | 1.4                                          | 2.8                       | 1381        |
| JG1025-79     | 32.7                                                                 | 4.9         | 0.281962                                  | 0.000027        | 0.001900                                  | 0.281912                                     | -29.1                     | 1.0                                          | 0.2                       | 1381        |
| JG 10-25PC-13 | 29.1                                                                 | 4.1         | 0.282013                                  | 0.000027        | 0.001623                                  | 0.281970                                     | -27.3                     | 1.0                                          | 2.3                       | 1384        |
| JG1025-01     | 53.7                                                                 | 4.3         | 0.281918                                  | 0.000035        | 0.003032                                  | 0.281838                                     | -30.7                     | 1.2                                          | -2.3                      | 1388        |
| JG 10-25PC-57 | 26.3                                                                 | 2.8         | 0.281929                                  | 0.000029        | 0.001462                                  | 0.281890                                     | -30.3                     | 1.0                                          | 0.4                       | 1425        |
| JG 10-25PC-39 | 10.1                                                                 | 3.2         | 0.282012                                  | 0.000036        | 0.000590                                  | 0.281996                                     | -27.3                     | 1.3                                          | 4.4                       | 1436        |
| JG1025-38     | 11.4                                                                 | 3.0         | 0.282000                                  | 0.000030        | 0.000654                                  | 0.281982                                     | -27.8                     | 1.1                                          | 4.1                       | 1444        |
| JG 10-25PC-50 | 38.4                                                                 | 3.6         | 0.282034                                  | 0.000028        | 0.003052                                  | 0.281950                                     | -26.6                     | 1.0                                          | 3.2                       | 1454        |
| JG 10-25PC-72 | 30.2                                                                 | 3.4         | 0.282093                                  | 0.000037        | 0.001898                                  | 0.282040                                     | -24.5                     | 1.3                                          | 6.7                       | 1467        |
| JG 10-25PC-17 | 11.6                                                                 | 3.8         | 0.282107                                  | 0.000034        | 0.000699                                  | 0.282087                                     | -24.0                     | 1.2                                          | 8.6                       | 1477        |
| JG 10-25PC-02 | 20.6                                                                 | 3.1         | 0.282032                                  | 0.000025        | 0.001181                                  | 0.281999                                     | -26.6                     | 0.9                                          | 5.6                       | 1483        |
| JG 10-25PC-07 | 21.3                                                                 | 3.2         | 0.282070                                  | 0.000037        | 0.001436                                  | 0.282030                                     | -25.3                     | 1.3                                          | 6.8                       | 1487        |
| JG1025-10     | 13.6                                                                 | 4.0         | 0.282011                                  | 0.000031        | 0.000836                                  | 0.281987                                     | -27.4                     | 1.1                                          | 6.0                       | 1520        |
| JG 10-25PC-70 | 24.8                                                                 | 3.1         | 0.282012                                  | 0.000035        | 0.001752                                  | 0.281962                                     | -27.3                     | 1.2                                          | 5.1                       | 1521        |
| JG 10-25PC-61 | 14.9                                                                 | 3.4         | 0.281885                                  | 0.000030        | 0.000846                                  | 0.281861                                     | -31.8                     | 1.1                                          | 1.6                       | 1523        |
| JG1025-71     | 33.2                                                                 | 3.4         | 0.282094                                  | 0.000035        | 0.002012                                  | 0.282035                                     | -24.4                     | 1.3                                          | 8.3                       | 1547        |
| JG 10-25PC-33 | 37.1                                                                 | 3.4         | 0.281979                                  | 0.000027        | 0.002199                                  | 0.281914                                     | -28.5                     | 1.0                                          | 4.4                       | 1564        |
| JG 10-25PC-49 | 8.2                                                                  | 3.4         | 0.281928                                  | 0.000031        | 0.000554                                  | 0.281912                                     | -30.3                     | 1.1                                          | 5.3                       | 1604        |
| JG 10-25PC-64 | 35.6                                                                 | 3.0         | 0.281981                                  | 0.000047        | 0.002463                                  | 0.281905                                     | -28.4                     | 1.7                                          | 5.4                       | 1618        |
| JG1025-36     | 19.0                                                                 | 3.2         | 0.281996                                  | 0.000031        | 0.001104                                  | 0.281962                                     | -27.9                     | 1.1                                          | 7.8                       | 1637        |
| JG 10-25PC-25 | 14.0                                                                 | 2.2         | 0.281780                                  | 0.000055        | 0.000955                                  | 0.281750                                     | -35.5                     | 1.9                                          | 0.5                       | 1647        |
| JG 10-25PC-48 | 18.5                                                                 | 2.4         | 0.281924                                  | 0.000043        | 0.001436                                  | 0.281879                                     | -30.4                     | 1.5                                          | 5.5                       | 1664        |
| JG 10-25PC-30 | 10.4                                                                 | 2.6         | 0.281972                                  | 0.000057        | 0.000681                                  | 0.281951                                     | -28.7                     | 2.0                                          | 8.0                       | 1664        |
| JG1025-57     | 12.8                                                                 | 3.2         | 0.281874                                  | 0.000033        | 0.000750                                  | 0.281850                                     | -32.2                     | 1.2                                          | 4.8                       | 1679        |
| JG1025-04     | 43.4                                                                 | 4.1         | 0.281996                                  | 0.000029        | 0.002670                                  | 0.281910                                     | -27.9                     | 1.0                                          | 7.1                       | 1686        |
| JG1025-24     | 14.5                                                                 | 3.4         | 0.281760                                  | 0.000028        | 0.000840                                  | 0.281733                                     | -36.2                     | 1.0                                          | 0.9                       | 1690        |
| JG1025-92     | 28.8                                                                 | 3.5         | 0.281915                                  | 0.000034        | 0.001691                                  | 0.281861                                     | -30.8                     | 1.2                                          | 5.5                       | 1691        |
| JG 10-25PC-59 | 36.4                                                                 | 3.2         | 0.282015                                  | 0.000033        | 0.002419                                  | 0.281937                                     | -27.2                     | 1.2                                          | 8.2                       | 1693        |
| JG 10-25PC-10 | 19.9                                                                 | 3.7         | 0.281979                                  | 0.000029        | 0.001081                                  | 0.281944                                     | -28.5                     | 1.0                                          | 8.6                       | 1701        |
| JG 10-25PC-12 | 29.8                                                                 | 3.5         | 0.281779                                  | 0.000046        | 0.001827                                  | 0.281720                                     | -35.6                     | 1.6                                          | 0.7                       | 1703        |
| JG 10-25PC-75 | 10.4                                                                 | 4.3         | 0.281871                                  | 0.000031        | 0.000714                                  | 0.281848                                     | -32.3                     | 1.1                                          | 5.5                       | 1712        |
| JG 10-25PC-22 | 21.2                                                                 | 3.7         | 0.281821                                  | 0.000034        | 0.001213                                  | 0.281782                                     | -34.1                     | 1.2                                          | 3.1                       | 1712        |
| JG 10-25PC-09 | 14.7                                                                 | 2.7         | 0.281995                                  | 0.000051        | 0.000890                                  | 0.281966                                     | -27.9                     | 1.8                                          | 9.8                       | 1716        |
| JG 10-25PC-43 | 38.1                                                                 | 3.7         | 0.281925                                  | 0.000033        | 0.002195                                  | 0.281853                                     | -30.4                     | 1.2                                          | 6.2                       | 1737        |
| JG 10-25PC-32 | 22.7                                                                 | 3.1         | 0.281828                                  | 0.000035        | 0.001285                                  | 0.281785                                     | -33.8                     | 1.3                                          | 3.9                       | 1739        |
| JG 10-25PC-27 | 26.8                                                                 | 3.2         | 0.281729                                  | 0.000028        | 0.001547                                  | 0.281678                                     | -37.3                     | 1.0                                          | 0.3                       | 1748        |
| JG 10-25PC-29 | 39.5                                                                 | 2.7         | 0.281952                                  | 0.000038        | 0.002281                                  | 0.281877                                     | -29.4                     | 1.3                                          | 7.4                       | 1750        |
| JG 10-25PC-68 | 32.2                                                                 | 3.6         | 0.281689                                  | 0.000029        | 0.001929                                  | 0.281624                                     | -38.8                     | 1.0                                          | -1.5                      | 1756        |
| JG 10-25PC-60 | 8.7                                                                  | 3.4         | 0.281765                                  | 0.000032        | 0.000697                                  | 0.281742                                     | -36.1                     | 1.1                                          | 2.8                       | 1760        |
| JG1025-25     | 10.6                                                                 | 2.5         | 0.281628                                  | 0.000043        | 0.000589                                  | 0.281609                                     | -40.9                     | 1.5                                          | -1.6                      | 1774        |
| JG 10-25PC-14 | 8.3                                                                  | 2.9         | 0.281810                                  | 0.000050        | 0.000538                                  | 0.281791                                     | -34.5                     | 1.8                                          | 5.0                       | 1777        |
| JG 10-25PC-42 | 14.5                                                                 | 3.0         | 0.281731                                  | 0.000034        | 0.000805                                  | 0.281704                                     | -37.3                     | 1.2                                          | 1.9                       | 1778        |
| JG 10-25PC-15 | 19.6                                                                 | 3.3         | 0.281653                                  | 0.000038        | 0.001217                                  | 0.281612                                     | -40.0                     | 1.3                                          | -1.3                      | 1782        |
| JG 10-25PC-74 | 19.1                                                                 | 3.7         | 0.281696                                  | 0.000029        | 0.001175                                  | 0.281656                                     | -38.5                     | 1.0                                          | 0.3                       | 1785        |
| JG 10-25PC-05 | 33.8                                                                 | 3.9         | 0.281620                                  | 0.000025        | 0.001945                                  | 0.281555                                     | -41.2                     | 0.9                                          | -3.3                      | 1785        |
| JG 10-25PC-08 | 11.3                                                                 | 2.1         | 0.281597                                  | 0.000043        | 0.000748                                  | 0.281572                                     | -42.0                     | 1.5                                          | -2.5                      | 1793        |
| JG 10-25PC-03 | 3.8                                                                  | 3.6         | 0.281633                                  | 0.000023        | 0.000215                                  | 0.281624                                     | -40.7                     | 0.8                                          | 8.3                       | 2176        |
| JG 10-25PC-46 | 19.0                                                                 | 3.1         | 0.281722                                  | 0.000035        | 0.001205                                  | 0.281670                                     | -37.6                     | 1.2                                          | 11.7                      | 2256        |

| Sample                                                  | $(\frac{^{176}\text{Yb} + ^{176}\text{Lu}}{^{176}\text{Hf}})$<br>(%) | Volts<br>Hf | $\frac{^{176}\text{Hf}}{^{177}\text{Hf}}$ | $\pm (1\sigma)$ | $\frac{^{176}\text{Lu}}{^{177}\text{Hf}}$ | $\frac{^{176}\text{Hf}}{^{177}\text{Hf}(t)}$ | $\epsilon \text{ Hf (0)}$ | $\epsilon \text{ Hf (0)}$<br>$\pm (1\sigma)$ | $\epsilon \text{ Hf (t)}$ | Age<br>(Ma) |
|---------------------------------------------------------|----------------------------------------------------------------------|-------------|-------------------------------------------|-----------------|-------------------------------------------|----------------------------------------------|---------------------------|----------------------------------------------|---------------------------|-------------|
| JG 10-25PC-67                                           | 15.5                                                                 | 3.1         | 0.281056                                  | 0.000031        | 0.000959                                  | 0.281007                                     | -61.1                     | 1.1                                          | -1.9                      | 2683        |
| <b>Sample JG09-05, Kodiak Fm (57.83622, -152.35168)</b> |                                                                      |             |                                           |                 |                                           |                                              |                           |                                              |                           |             |
| JG09-05-14                                              | 18.9                                                                 | 4.1         | 0.283075                                  | 0.000032        | 0.001264                                  | 0.283074                                     | 10.3                      | 1.1                                          | 11.7                      | 68          |
| JG09-05-36                                              | 29.6                                                                 | 3.0         | 0.282992                                  | 0.000028        | 0.001829                                  | 0.282990                                     | 7.3                       | 1.0                                          | 8.8                       | 70          |
| JG09-05-37                                              | 36.8                                                                 | 3.0         | 0.283013                                  | 0.000031        | 0.001818                                  | 0.283010                                     | 8.1                       | 1.1                                          | 9.5                       | 70          |
| JG09-05-99                                              | 10.6                                                                 | 4.5         | 0.282940                                  | 0.000024        | 0.000647                                  | 0.282939                                     | 5.5                       | 0.8                                          | 7.4                       | 86          |
| JG09-05-11                                              | 0.3                                                                  | 3.7         | 0.282233                                  | 0.000024        | 0.000013                                  | 0.282233                                     | -19.5                     | 0.8                                          | -17.5                     | 93          |
| JG09-05-52                                              | 18.4                                                                 | 3.4         | 0.282951                                  | 0.000033        | 0.001374                                  | 0.282948                                     | 5.9                       | 1.2                                          | 7.9                       | 97          |
| JG09-05-78                                              | 13.7                                                                 | 3.3         | 0.282907                                  | 0.000030        | 0.001094                                  | 0.282905                                     | 4.3                       | 1.1                                          | 6.4                       | 98          |
| JG09-05-95                                              | 20.3                                                                 | 3.2         | 0.282620                                  | 0.000029        | 0.001233                                  | 0.282618                                     | -5.8                      | 1.0                                          | -3.7                      | 98          |
| JG09-05-08                                              | 30.1                                                                 | 4.7         | 0.283050                                  | 0.000026        | 0.001935                                  | 0.283047                                     | 9.4                       | 0.9                                          | 11.5                      | 100         |
| JG09-05-92                                              | 11.1                                                                 | 3.2         | 0.282699                                  | 0.000037        | 0.000798                                  | 0.282697                                     | -3.1                      | 1.3                                          | -0.9                      | 101         |
| JG09-05-85                                              | 14.6                                                                 | 3.0         | 0.282893                                  | 0.000032        | 0.001001                                  | 0.282891                                     | 3.8                       | 1.1                                          | 6.0                       | 102         |
| JG09-05-69                                              | 9.9                                                                  | 4.1         | 0.282888                                  | 0.000027        | 0.000738                                  | 0.282886                                     | 3.7                       | 1.0                                          | 7.2                       | 163         |
| JG09-05-03                                              | 12.7                                                                 | 3.1         | 0.282984                                  | 0.000026        | 0.000900                                  | 0.282981                                     | 7.0                       | 0.9                                          | 10.6                      | 164         |
| JG09-05-10                                              | 22.4                                                                 | 3.7         | 0.282957                                  | 0.000023        | 0.001641                                  | 0.282952                                     | 6.1                       | 0.8                                          | 9.6                       | 167         |
| JG09-05-94                                              | 48.1                                                                 | 2.6         | 0.283016                                  | 0.000033        | 0.003685                                  | 0.283004                                     | 8.2                       | 1.2                                          | 11.7                      | 177         |
| JG09-05-38                                              | 16.1                                                                 | 4.6         | 0.282953                                  | 0.000036        | 0.000980                                  | 0.282950                                     | 5.9                       | 1.3                                          | 9.9                       | 183         |
| JG09-05-33                                              | 22.3                                                                 | 3.7         | 0.282569                                  | 0.000037        | 0.001458                                  | 0.282564                                     | -7.6                      | 1.3                                          | -3.7                      | 185         |
| JG09-05-29                                              | 18.9                                                                 | 3.3         | 0.282639                                  | 0.000029        | 0.001247                                  | 0.282635                                     | -5.2                      | 1.0                                          | -1.2                      | 187         |
| JG09-05-24                                              | 19.9                                                                 | 3.5         | 0.282714                                  | 0.000029        | 0.001510                                  | 0.282709                                     | -2.5                      | 1.0                                          | 1.7                       | 198         |
| JG09-05-89                                              | 11.9                                                                 | 3.3         | 0.282663                                  | 0.000026        | 0.000827                                  | 0.282660                                     | -4.3                      | 0.9                                          | 0.1                       | 202         |
| JG09-05-22                                              | 92.6                                                                 | 2.8         | 0.282947                                  | 0.000045        | 0.005889                                  | 0.282924                                     | 5.7                       | 1.6                                          | 9.6                       | 208         |
| JG09-05-20                                              | 24.4                                                                 | 3.2         | 0.282527                                  | 0.000040        | 0.001499                                  | 0.282519                                     | -9.1                      | 1.4                                          | -3.6                      | 260         |
| JG09-05-34                                              | 19.7                                                                 | 3.2         | 0.282899                                  | 0.000038        | 0.001272                                  | 0.282891                                     | 4.0                       | 1.3                                          | 10.8                      | 314         |
| JG09-05-02                                              | 25.5                                                                 | 3.0         | 0.282476                                  | 0.000036        | 0.001683                                  | 0.282466                                     | -10.9                     | 1.3                                          | -3.8                      | 339         |
| JG09-05-42                                              | 15.1                                                                 | 3.2         | 0.282374                                  | 0.000029        | 0.001049                                  | 0.282367                                     | -14.5                     | 1.0                                          | -6.8                      | 357         |
| JG09-05-PCY32                                           | 12.3                                                                 | 2.8         | 0.282213                                  | 0.000037        | 0.000705                                  | 0.282208                                     | -20.2                     | 1.3                                          | -12.2                     | 369         |
| JG09-05-55                                              | 20.4                                                                 | 3.4         | 0.282206                                  | 0.000035        | 0.001190                                  | 0.282198                                     | -20.5                     | 1.2                                          | -12.5                     | 371         |
| JG09-05-58                                              | 17.3                                                                 | 3.1         | 0.282091                                  | 0.000035        | 0.001032                                  | 0.282084                                     | -24.5                     | 1.2                                          | -16.5                     | 372         |
| JG09-05-70                                              | 5.4                                                                  | 4.1         | 0.282348                                  | 0.000033        | 0.000325                                  | 0.282346                                     | -15.4                     | 1.2                                          | -6.2                      | 420         |
| JG09-05-93                                              | 34.5                                                                 | 3.2         | 0.282393                                  | 0.000031        | 0.002025                                  | 0.282372                                     | -13.9                     | 1.1                                          | -2.2                      | 557         |
| JG09-05-48                                              | 13.0                                                                 | 3.2         | 0.282340                                  | 0.000033        | 0.000741                                  | 0.282326                                     | -15.7                     | 1.2                                          | 7.4                       | 1053        |
| JG09-05-PCY36                                           | 18.3                                                                 | 3.9         | 0.282016                                  | 0.000027        | 0.001103                                  | 0.281991                                     | -27.2                     | 1.0                                          | -1.2                      | 1199        |
| JG09-05-PCY16                                           | 61.2                                                                 | 2.1         | 0.282322                                  | 0.000041        | 0.003143                                  | 0.282250                                     | -16.4                     | 1.5                                          | 8.1                       | 1201        |
| JG09-05-PCY40                                           | 17.1                                                                 | 3.6         | 0.282038                                  | 0.000026        | 0.000920                                  | 0.282017                                     | -26.4                     | 0.9                                          | 0.7                       | 1241        |
| JG09-05-63                                              | 28.7                                                                 | 3.7         | 0.282218                                  | 0.000027        | 0.001539                                  | 0.282180                                     | -20.0                     | 0.9                                          | 8.5                       | 1332        |
| JG09-05-47                                              | 12.9                                                                 | 4.1         | 0.281801                                  | 0.000035        | 0.000738                                  | 0.281782                                     | -34.8                     | 1.2                                          | -4.3                      | 1387        |
| JG09-05-PCY05                                           | 17.1                                                                 | 2.8         | 0.281941                                  | 0.000028        | 0.001022                                  | 0.281914                                     | -29.8                     | 1.0                                          | 1.0                       | 1414        |
| JG09-05-PCY10                                           | 24.5                                                                 | 4.0         | 0.282024                                  | 0.000030        | 0.001427                                  | 0.281985                                     | -26.9                     | 1.0                                          | 4.0                       | 1436        |
| JG09-05-PCY27                                           | 13.4                                                                 | 4.2         | 0.281926                                  | 0.000029        | 0.000759                                  | 0.281904                                     | -30.4                     | 1.0                                          | 2.9                       | 1513        |
| JG09-05-PCY01                                           | 17.4                                                                 | 3.7         | 0.281908                                  | 0.000026        | 0.000976                                  | 0.281880                                     | -31.0                     | 0.9                                          | 2.3                       | 1523        |
| JG09-05-64                                              | 10.9                                                                 | 4.3         | 0.282007                                  | 0.000029        | 0.000710                                  | 0.281986                                     | -27.5                     | 1.0                                          | 7.4                       | 1582        |
| JG09-05-PCY33                                           | 9.6                                                                  | 4.0         | 0.281807                                  | 0.000026        | 0.000597                                  | 0.281787                                     | -34.6                     | 0.9                                          | 4.3                       | 1754        |
| JG09-05-PCY11                                           | 8.5                                                                  | 3.6         | 0.281534                                  | 0.000028        | 0.000489                                  | 0.281518                                     | -44.2                     | 1.0                                          | -4.7                      | 1779        |
| JG09-05-32                                              | 16.1                                                                 | 3.6         | 0.281628                                  | 0.000029        | 0.000872                                  | 0.281599                                     | -40.9                     | 1.0                                          | -1.7                      | 1785        |
| JG09-05-PCY12                                           | 16.4                                                                 | 4.2         | 0.281744                                  | 0.000030        | 0.000920                                  | 0.281712                                     | -36.8                     | 1.1                                          | 2.4                       | 1787        |
| JG09-05-PCY18                                           | 2.3                                                                  | 3.7         | 0.281860                                  | 0.000031        | 0.000187                                  | 0.281853                                     | -32.7                     | 1.1                                          | 7.4                       | 1787        |
| JG09-05-PCY09                                           | 10.3                                                                 | 3.1         | 0.281437                                  | 0.000030        | 0.000569                                  | 0.281417                                     | -47.7                     | 1.1                                          | -7.8                      | 1801        |
| JG09-05-PCY17                                           | 18.6                                                                 | 3.3         | 0.281638                                  | 0.000044        | 0.001094                                  | 0.281600                                     | -40.6                     | 1.5                                          | -1.1                      | 1809        |
| JG09-05-PCY39                                           | 10.4                                                                 | 2.7         | 0.281485                                  | 0.000039        | 0.000590                                  | 0.281464                                     | -46.0                     | 1.4                                          | -5.3                      | 1835        |
| JG09-05-PCY25                                           | 7.9                                                                  | 3.2         | 0.281720                                  | 0.000030        | 0.000461                                  | 0.281703                                     | -37.7                     | 1.1                                          | 3.3                       | 1840        |
| JG09-05-PCY37                                           | 30.0                                                                 | 2.9         | 0.281810                                  | 0.000031        | 0.001467                                  | 0.281759                                     | -34.5                     | 1.1                                          | 5.4                       | 1845        |
| JG09-05-PCY03                                           | 9.7                                                                  | 3.4         | 0.281524                                  | 0.000034        | 0.000574                                  | 0.281504                                     | -44.6                     | 1.2                                          | -3.6                      | 1848        |
| JG09-05-PCY07                                           | 21.6                                                                 | 3.7         | 0.281687                                  | 0.000026        | 0.001246                                  | 0.281643                                     | -38.8                     | 0.9                                          | 1.4                       | 1849        |
| JG09-05-PCY04                                           | 5.0                                                                  | 4.3         | 0.281506                                  | 0.000027        | 0.000306                                  | 0.281495                                     | -45.2                     | 0.9                                          | -3.8                      | 1852        |
| JG09-05-PCY35                                           | 4.1                                                                  | 3.8         | 0.281430                                  | 0.000030        | 0.000287                                  | 0.281419                                     | -47.9                     | 1.1                                          | -6.4                      | 1857        |
| JG09-05-54                                              | 11.6                                                                 | 3.1         | 0.281544                                  | 0.000022        | 0.000690                                  | 0.281519                                     | -43.9                     | 0.8                                          | -2.4                      | 1875        |

| Sample        | $(\frac{^{176}\text{Yb} + ^{176}\text{Lu}}{^{176}\text{Hf}})$<br>(%) | Volts<br>Hf | $\frac{^{176}\text{Hf}}{^{177}\text{Hf}}$ | $\pm (1\sigma)$ | $\frac{^{176}\text{Lu}}{^{177}\text{Hf}}$ | $\frac{^{176}\text{Hf}}{^{177}\text{Hf}(t)}$ | $\epsilon \text{ Hf (0)}$ | $\epsilon \text{ Hf (0)}$<br>$\pm (1\sigma)$ | $\epsilon \text{ Hf (t)}$ | Age<br>(Ma) |
|---------------|----------------------------------------------------------------------|-------------|-------------------------------------------|-----------------|-------------------------------------------|----------------------------------------------|---------------------------|----------------------------------------------|---------------------------|-------------|
| JG09-05-PCY15 | 5.6                                                                  | 4.4         | 0.281609                                  | 0.000030        | 0.000340                                  | 0.281597                                     | -41.6                     | 1.1                                          | 0.7                       | 1893        |
| JG09-05-07    | 8.6                                                                  | 3.4         | 0.281431                                  | 0.000033        | 0.000527                                  | 0.281412                                     | -47.9                     | 1.2                                          | -5.5                      | 1908        |
| JG09-05-PCY22 | 10.4                                                                 | 3.5         | 0.281585                                  | 0.000038        | 0.000622                                  | 0.281563                                     | -42.4                     | 1.3                                          | -0.0                      | 1913        |
| JG09-05-17    | 2.8                                                                  | 3.0         | 0.281406                                  | 0.000035        | 0.000140                                  | 0.281401                                     | -48.8                     | 1.2                                          | -5.6                      | 1918        |
| JG09-05-65    | 12.5                                                                 | 3.5         | 0.281605                                  | 0.000033        | 0.000828                                  | 0.281575                                     | -41.7                     | 1.2                                          | 0.7                       | 1928        |
| JG09-05-41    | 4.8                                                                  | 3.8         | 0.281450                                  | 0.000031        | 0.000300                                  | 0.281439                                     | -47.2                     | 1.1                                          | -4.0                      | 1929        |
| JG09-05-PCY31 | 20.1                                                                 | 3.3         | 0.281480                                  | 0.000038        | 0.001183                                  | 0.281435                                     | -46.2                     | 1.4                                          | -2.7                      | 1993        |
| JG09-05-PCY06 | 10.4                                                                 | 3.9         | 0.281508                                  | 0.000031        | 0.000623                                  | 0.281484                                     | -45.2                     | 1.1                                          | -0.9                      | 1994        |
| JG09-05-PCY21 | 11.0                                                                 | 3.6         | 0.281427                                  | 0.000035        | 0.000641                                  | 0.281402                                     | -48.0                     | 1.2                                          | -3.8                      | 1996        |
| JG09-05-79    | 9.2                                                                  | 2.4         | 0.281447                                  | 0.000037        | 0.000555                                  | 0.281426                                     | -47.3                     | 1.3                                          | -2.9                      | 2000        |
| JG09-05-PCY38 | 9.4                                                                  | 3.0         | 0.281377                                  | 0.000031        | 0.000547                                  | 0.281356                                     | -49.8                     | 1.1                                          | -5.3                      | 2002        |
| JG09-05-88    | 14.2                                                                 | 2.8         | 0.281443                                  | 0.000033        | 0.000859                                  | 0.281410                                     | -47.4                     | 1.2                                          | -3.1                      | 2016        |
| JG09-05-PCY41 | 10.8                                                                 | 3.2         | 0.281291                                  | 0.000030        | 0.000610                                  | 0.281264                                     | -52.8                     | 1.0                                          | -1.8                      | 2293        |
| JG09-05-04    | 18.2                                                                 | 3.4         | 0.281311                                  | 0.000038        | 0.001267                                  | 0.281256                                     | -52.1                     | 1.3                                          | -1.8                      | 2306        |
| JG09-05-PCY08 | 11.2                                                                 | 3.2         | 0.281199                                  | 0.000039        | 0.000640                                  | 0.281171                                     | -56.1                     | 1.4                                          | -4.6                      | 2318        |
| JG09-05-PCY30 | 11.3                                                                 | 3.3         | 0.281201                                  | 0.000029        | 0.000665                                  | 0.281170                                     | -56.0                     | 1.0                                          | -1.1                      | 2470        |
| JG09-05-PCY20 | 10.1                                                                 | 3.9         | 0.281221                                  | 0.000029        | 0.000608                                  | 0.281192                                     | -55.3                     | 1.0                                          | 0.9                       | 2521        |
| JG09-05-PCY02 | 8.7                                                                  | 3.3         | 0.281218                                  | 0.000029        | 0.000510                                  | 0.281193                                     | -55.4                     | 1.0                                          | 2.2                       | 2575        |
| JG09-05-PCY19 | 8.5                                                                  | 3.8         | 0.281208                                  | 0.000027        | 0.000496                                  | 0.281183                                     | -55.8                     | 0.9                                          | 2.5                       | 2600        |
| JG09-05-PCY14 | 6.2                                                                  | 3.6         | 0.281044                                  | 0.000033        | 0.000376                                  | 0.281025                                     | -61.6                     | 1.2                                          | -0.6                      | 2709        |
| JG09-05-PCY23 | 11.9                                                                 | 3.3         | 0.280966                                  | 0.000029        | 0.000693                                  | 0.280929                                     | -64.3                     | 1.0                                          | -3.4                      | 2735        |

**Sample NI12-04, Shumagin Fm (55.156140°, -160.017880°)**

|             |      |     |          |          |          |          |      |     |      |     |
|-------------|------|-----|----------|----------|----------|----------|------|-----|------|-----|
| NI12-04-105 | 14.8 | 3.4 | 0.282942 | 0.000038 | 0.001065 | 0.282941 | 5.6  | 1.4 | 7.1  | 70  |
| NI12-04-50  | 19.6 | 3.2 | 0.282987 | 0.000027 | 0.001379 | 0.282985 | 7.2  | 0.9 | 8.7  | 73  |
| NI12-04-112 | 9.8  | 3.4 | 0.283000 | 0.000030 | 0.000703 | 0.282999 | 7.6  | 1.0 | 9.2  | 73  |
| NI12-04-26  | 13.4 | 3.3 | 0.282947 | 0.000027 | 0.000951 | 0.282946 | 5.7  | 1.0 | 7.3  | 73  |
| NI12-04-97  | 9.8  | 3.6 | 0.283025 | 0.000031 | 0.000715 | 0.283024 | 8.5  | 1.1 | 10.1 | 74  |
| NI12-04-11  | 12.1 | 3.5 | 0.283038 | 0.000030 | 0.000852 | 0.283037 | 9.0  | 1.1 | 10.6 | 74  |
| NI12-04-17  | 30.8 | 3.6 | 0.283041 | 0.000037 | 0.001933 | 0.283038 | 9.0  | 1.3 | 10.9 | 89  |
| NI12-04-93  | 34.0 | 3.4 | 0.283063 | 0.000036 | 0.002329 | 0.283059 | 9.8  | 1.3 | 11.7 | 89  |
| NI12-04-117 | 17.3 | 3.1 | 0.282895 | 0.000039 | 0.001293 | 0.282893 | 3.9  | 1.4 | 5.8  | 91  |
| NI12-04-83  | 17.5 | 4.5 | 0.283005 | 0.000021 | 0.001247 | 0.283003 | 7.8  | 0.8 | 9.8  | 94  |
| NI12-04-40  | 18.7 | 3.4 | 0.282960 | 0.000027 | 0.001334 | 0.282958 | 6.2  | 0.9 | 8.3  | 97  |
| NI12-04-24  | 18.3 | 3.2 | 0.283018 | 0.000033 | 0.001213 | 0.283015 | 8.2  | 1.2 | 11.4 | 149 |
| NI12-04-77  | 6.9  | 4.8 | 0.282917 | 0.000024 | 0.000572 | 0.282916 | 4.7  | 0.8 | 8.0  | 150 |
| NI12-04-78  | 22.4 | 3.4 | 0.282976 | 0.000036 | 0.001487 | 0.282971 | 6.8  | 1.3 | 10.2 | 160 |
| NI12-04-35  | 19.2 | 3.8 | 0.282844 | 0.000030 | 0.001300 | 0.282840 | 2.1  | 1.1 | 5.7  | 168 |
| NI12-04-53  | 42.3 | 4.0 | 0.282825 | 0.000027 | 0.002716 | 0.282817 | 1.4  | 1.0 | 4.9  | 170 |
| NI12-04-74  | 21.7 | 3.6 | 0.282900 | 0.000026 | 0.001551 | 0.282895 | 4.1  | 0.9 | 7.8  | 173 |
| NI12-04-72  | 68.5 | 2.8 | 0.282774 | 0.000035 | 0.004531 | 0.282759 | -0.4 | 1.2 | 3.0  | 174 |
| NI12-04-51  | 19.0 | 3.1 | 0.282882 | 0.000026 | 0.001258 | 0.282877 | 3.4  | 0.9 | 7.4  | 186 |
| NI12-04-103 | 23.4 | 2.7 | 0.282964 | 0.000032 | 0.001798 | 0.282958 | 6.3  | 1.1 | 10.4 | 194 |

**Sample NI12-11, Shumagin Fm (55.201560°, -160.042690°)**

|             |      |     |          |          |          |          |      |     |      |     |
|-------------|------|-----|----------|----------|----------|----------|------|-----|------|-----|
| NI12-11-44  | 14.5 | 3.2 | 0.282909 | 0.000035 | 0.000975 | 0.282908 | 4.4  | 1.2 | 5.9  | 72  |
| NI12-11-01  | 15.6 | 2.9 | 0.282874 | 0.000039 | 0.000977 | 0.282872 | 3.1  | 1.4 | 4.7  | 72  |
| NI12-11-29  | 9.0  | 3.2 | 0.282836 | 0.000030 | 0.000530 | 0.282835 | 1.8  | 1.1 | 3.4  | 73  |
| NI12-11-97  | 14.3 | 3.3 | 0.283002 | 0.000029 | 0.000946 | 0.283001 | 7.7  | 1.0 | 9.3  | 74  |
| NI12-11-39  | 10.6 | 3.2 | 0.282917 | 0.000022 | 0.000733 | 0.282916 | 4.7  | 0.8 | 6.3  | 75  |
| NI12-11-31  | 12.6 | 3.5 | 0.282974 | 0.000028 | 0.001022 | 0.282972 | 6.7  | 1.0 | 8.4  | 80  |
| NI12-11-35  | 10.4 | 3.2 | 0.282760 | 0.000029 | 0.000739 | 0.282759 | -0.9 | 1.0 | 0.9  | 83  |
| NI12-11-45  | 13.2 | 3.3 | 0.282877 | 0.000034 | 0.000891 | 0.282876 | 3.3  | 1.2 | 5.1  | 87  |
| NI12-11-98  | 33.3 | 3.5 | 0.282838 | 0.000031 | 0.002292 | 0.282834 | 1.9  | 1.1 | 3.7  | 88  |
| NI12-11-56  | 20.4 | 3.2 | 0.282901 | 0.000034 | 0.001430 | 0.282899 | 4.1  | 1.2 | 6.2  | 97  |
| NI12-11-36  | 10.4 | 3.8 | 0.282972 | 0.000032 | 0.000750 | 0.282969 | 6.6  | 1.1 | 9.9  | 154 |
| NI12-11-100 | 6.9  | 3.6 | 0.282862 | 0.000030 | 0.000431 | 0.282861 | 2.7  | 1.1 | 6.1  | 156 |
| NI12-11-03  | 14.1 | 3.2 | 0.282632 | 0.000038 | 0.001044 | 0.282629 | -5.4 | 1.3 | -1.9 | 164 |
| NI12-11-42  | 22.3 | 3.3 | 0.282801 | 0.000030 | 0.001553 | 0.282796 | 0.6  | 1.1 | 4.1  | 167 |



| Sample     | $(\frac{^{176}\text{Yb} + ^{176}\text{Lu}}{^{176}\text{Hf}})$<br>(%) | Volts<br>Hf | $\frac{^{176}\text{Hf}}{^{177}\text{Hf}}$ | $\pm (1\sigma)$ | $\frac{^{176}\text{Lu}}{^{177}\text{Hf}}$ | $\frac{^{176}\text{Hf}}{^{177}\text{Hf}(t)}$ | $\epsilon \text{ Hf (0)}$ | $\epsilon \text{ Hf (0)}$<br>$\pm (1\sigma)$ | $\epsilon \text{ Hf (t)}$ | Age<br>(Ma) |
|------------|----------------------------------------------------------------------|-------------|-------------------------------------------|-----------------|-------------------------------------------|----------------------------------------------|---------------------------|----------------------------------------------|---------------------------|-------------|
| NI12-11-20 | 30.5                                                                 | 3.0         | 0.282795                                  | 0.000034        | 0.002077                                  | 0.282789                                     | 0.4                       | 1.2                                          | 3.9                       | 168         |
| NI12-11-52 | 9.9                                                                  | 3.6         | 0.282884                                  | 0.000037        | 0.000881                                  | 0.282881                                     | 3.5                       | 1.3                                          | 7.2                       | 172         |
| NI12-11-80 | 19.7                                                                 | 2.5         | 0.282910                                  | 0.000031        | 0.001445                                  | 0.282905                                     | 4.4                       | 1.1                                          | 8.2                       | 176         |
| NI12-11-49 | 18.0                                                                 | 3.7         | 0.282853                                  | 0.000041        | 0.001259                                  | 0.282849                                     | 2.4                       | 1.5                                          | 6.2                       | 177         |
| NI12-11-96 | 9.5                                                                  | 3.1         | 0.282917                                  | 0.000033        | 0.000530                                  | 0.282915                                     | 4.7                       | 1.2                                          | 8.6                       | 181         |
| NI12-11-09 | 14.5                                                                 | 3.5         | 0.282829                                  | 0.000029        | 0.001028                                  | 0.282825                                     | 1.5                       | 1.0                                          | 5.5                       | 183         |
| NI12-11-26 | 4.0                                                                  | 3.5         | 0.281240                                  | 0.000035        | 0.000200                                  | 0.281233                                     | -54.6                     | 1.2                                          | -11.6                     | 1918        |
| NI12-11-48 | 2.5                                                                  | 3.4         | 0.280996                                  | 0.000029        | 0.000195                                  | 0.280986                                     | -63.3                     | 1.0                                          | -0.9                      | 2757        |

**Sample NI12-14, Shumagin Fm (55.083130°,-159.939410°)**

|             |      |     |          |          |          |          |       |     |      |      |
|-------------|------|-----|----------|----------|----------|----------|-------|-----|------|------|
| NI12-14-41  | 15.0 | 2.7 | 0.283015 | 0.000038 | 0.000969 | 0.283013 | 8.1   | 1.3 | 9.7  | 71   |
| NI12-14-68  | 18.6 | 2.9 | 0.282952 | 0.000035 | 0.001196 | 0.282950 | 5.9   | 1.2 | 7.4  | 72   |
| NI12-14-32  | 15.5 | 2.7 | 0.283043 | 0.000030 | 0.001037 | 0.283042 | 9.1   | 1.1 | 10.7 | 72   |
| NI12-14-31  | 13.1 | 2.6 | 0.283034 | 0.000028 | 0.000917 | 0.283033 | 8.8   | 1.0 | 10.4 | 73   |
| NI12-14-48  | 16.6 | 2.4 | 0.282983 | 0.000036 | 0.001134 | 0.282981 | 7.0   | 1.3 | 8.6  | 73   |
| NI12-14-109 | 15.5 | 2.7 | 0.282996 | 0.000033 | 0.001071 | 0.282994 | 7.5   | 1.2 | 9.0  | 74   |
| NI12-14-39  | 19.2 | 2.6 | 0.283005 | 0.000032 | 0.001256 | 0.283004 | 7.8   | 1.1 | 9.4  | 74   |
| NI12-14-98  | 18.7 | 2.6 | 0.282991 | 0.000027 | 0.001205 | 0.282990 | 7.3   | 1.0 | 8.9  | 74   |
| NI12-14-112 | 13.5 | 2.8 | 0.283031 | 0.000031 | 0.000903 | 0.283029 | 8.7   | 1.1 | 10.3 | 76   |
| NI12-14-59  | 16.2 | 2.6 | 0.282961 | 0.000031 | 0.001081 | 0.282960 | 6.2   | 1.1 | 7.9  | 77   |
| NI12-14-03  | 26.7 | 2.4 | 0.283058 | 0.000042 | 0.001647 | 0.283055 | 9.7   | 1.5 | 11.5 | 88   |
| NI12-14-47  | 11.5 | 2.9 | 0.282941 | 0.000036 | 0.000766 | 0.282939 | 5.5   | 1.3 | 9.0  | 158  |
| NI12-14-102 | 8.3  | 3.2 | 0.282949 | 0.000033 | 0.000561 | 0.282947 | 5.8   | 1.2 | 9.2  | 158  |
| NI12-14-14  | 19.5 | 2.6 | 0.282907 | 0.000033 | 0.001353 | 0.282903 | 4.3   | 1.2 | 7.8  | 164  |
| NI12-14-50  | 19.3 | 2.4 | 0.282865 | 0.000034 | 0.001268 | 0.282861 | 2.8   | 1.2 | 6.3  | 165  |
| NI12-14-55  | 16.0 | 2.7 | 0.282966 | 0.000036 | 0.001205 | 0.282962 | 6.4   | 1.3 | 10.1 | 172  |
| NI12-14-113 | 80.3 | 1.8 | 0.282955 | 0.000047 | 0.004978 | 0.282938 | 6.0   | 1.7 | 9.4  | 178  |
| NI12-14-100 | 43.6 | 2.0 | 0.282909 | 0.000037 | 0.002932 | 0.282899 | 4.4   | 1.3 | 8.2  | 185  |
| NI12-14-37  | 20.2 | 4.3 | 0.283001 | 0.000029 | 0.001383 | 0.282996 | 7.6   | 1.0 | 11.6 | 187  |
| NI12-14-94  | 12.4 | 2.5 | 0.283033 | 0.000037 | 0.000738 | 0.283030 | 8.8   | 1.3 | 12.9 | 189  |
| NI12-14-05  | 15.5 | 2.8 | 0.282034 | 0.000038 | 0.000860 | 0.282010 | -26.6 | 1.3 | 5.1  | 1445 |
| NI12-14-73  | 5.1  | 3.0 | 0.281550 | 0.000030 | 0.000289 | 0.281540 | -43.7 | 1.1 | -3.9 | 1779 |
| NI12-14-02  | 23.0 | 2.7 | 0.281644 | 0.000038 | 0.001310 | 0.281598 | -40.3 | 1.3 | -0.4 | 1843 |
| NI12-14-103 | 7.9  | 2.6 | 0.281799 | 0.000039 | 0.000451 | 0.281783 | -34.9 | 1.4 | 6.9  | 1872 |

**Sample NI12-23, Shumagin Fm (55.228080°,-159.921130°)**

|             |      |     |          |          |          |          |       |     |      |      |
|-------------|------|-----|----------|----------|----------|----------|-------|-----|------|------|
| NI12-23-07  | 28.5 | 3.1 | 0.283108 | 0.000027 | 0.001870 | 0.283105 | 11.4  | 1.0 | 13.0 | 73   |
| NI12-23-27  | 16.9 | 3.3 | 0.282924 | 0.000028 | 0.001228 | 0.282922 | 4.9   | 1.0 | 6.5  | 75   |
| NI12-23-75  | 8.5  | 3.0 | 0.282875 | 0.000033 | 0.000598 | 0.282874 | 3.2   | 1.2 | 4.8  | 76   |
| NI12-23-49  | 17.9 | 3.1 | 0.282951 | 0.000029 | 0.001095 | 0.282949 | 5.9   | 1.0 | 7.6  | 81   |
| NI12-23-74  | 20.4 | 3.0 | 0.282914 | 0.000027 | 0.001374 | 0.282912 | 4.6   | 1.0 | 6.4  | 84   |
| NI12-23-33  | 57.6 | 2.9 | 0.283114 | 0.000035 | 0.003189 | 0.283109 | 11.6  | 1.2 | 13.4 | 89   |
| NI12-23-22  | 24.8 | 2.8 | 0.283004 | 0.000038 | 0.001749 | 0.283001 | 7.8   | 1.4 | 9.7  | 92   |
| NI12-23-89  | 17.2 | 3.4 | 0.282705 | 0.000028 | 0.001081 | 0.282703 | -2.8  | 1.0 | -0.7 | 101  |
| NI12-23-47  | 24.5 | 2.4 | 0.282721 | 0.000035 | 0.001439 | 0.282718 | -2.3  | 1.2 | 0.1  | 112  |
| NI12-23-06  | 6.9  | 3.4 | 0.282957 | 0.000029 | 0.000432 | 0.282956 | 6.1   | 1.0 | 9.4  | 152  |
| NI12-23-60  | 36.4 | 3.4 | 0.282786 | 0.000037 | 0.002441 | 0.282779 | 0.1   | 1.3 | 3.3  | 159  |
| NI12-23-83  | 15.5 | 3.2 | 0.282854 | 0.000027 | 0.001117 | 0.282851 | 2.4   | 1.0 | 5.9  | 162  |
| NI12-23-41  | 8.9  | 3.8 | 0.282810 | 0.000027 | 0.000625 | 0.282808 | 0.9   | 1.0 | 4.4  | 163  |
| NI12-23-97  | 16.3 | 3.1 | 0.282751 | 0.000032 | 0.001212 | 0.282747 | -1.2  | 1.1 | 2.4  | 167  |
| NI12-23-29  | 7.9  | 3.2 | 0.282852 | 0.000037 | 0.000548 | 0.282851 | 2.4   | 1.3 | 6.0  | 167  |
| NI12-23-35  | 16.5 | 3.3 | 0.282949 | 0.000032 | 0.000918 | 0.282946 | 5.8   | 1.1 | 9.6  | 174  |
| NI12-23-85  | 13.0 | 2.7 | 0.282980 | 0.000034 | 0.000941 | 0.282977 | 6.9   | 1.2 | 10.7 | 174  |
| NI12-23-69  | 15.3 | 3.1 | 0.283008 | 0.000034 | 0.001094 | 0.283004 | 7.9   | 1.2 | 11.8 | 181  |
| NI12-23-44  | 40.8 | 2.4 | 0.282583 | 0.000030 | 0.002624 | 0.282574 | -7.1  | 1.1 | -3.2 | 193  |
| NI12-23-04  | 25.3 | 2.6 | 0.282536 | 0.000044 | 0.001743 | 0.282523 | -8.8  | 1.6 | -0.1 | 413  |
| NI12-23-107 | 13.1 | 2.7 | 0.281409 | 0.000036 | 0.000736 | 0.281382 | -48.7 | 1.3 | -6.3 | 1918 |
| NI12-23-106 | 14.1 | 3.0 | 0.281499 | 0.000036 | 0.000748 | 0.281470 | -45.5 | 1.3 | 0.7  | 2085 |

| Sample                                                | $(\frac{^{176}\text{Yb} + ^{176}\text{Lu}}{^{176}\text{Hf}})$<br>(%) | Volts<br>Hf | $\frac{^{176}\text{Hf}}{^{177}\text{Hf}}$ | $\pm (1\sigma)$ | $\frac{^{176}\text{Lu}}{^{177}\text{Hf}}$ | $\frac{^{176}\text{Hf}}{^{177}\text{Hf}(t)}$ | $\epsilon \text{ Hf } (0)$ | $\epsilon \text{ Hf } (0)$<br>$\pm (1\sigma)$ | $\epsilon \text{ Hf } (t)$ | Age<br>(Ma) |
|-------------------------------------------------------|----------------------------------------------------------------------|-------------|-------------------------------------------|-----------------|-------------------------------------------|----------------------------------------------|----------------------------|-----------------------------------------------|----------------------------|-------------|
| <b>Sample RB12-02, Orca Fm (60.00947, -149.32280)</b> |                                                                      |             |                                           |                 |                                           |                                              |                            |                                               |                            |             |
| RB12-02-30                                            | 24.7                                                                 | 5.0         | 0.282772                                  | 0.000026        | 0.001454                                  | 0.282771                                     | -0.4                       | 0.9                                           | 0.9                        | 62          |
| RB12-02-70                                            | 24.7                                                                 | 3.2         | 0.282797                                  | 0.000036        | 0.001517                                  | 0.282795                                     | 0.4                        | 1.3                                           | 1.8                        | 63          |
| RB12-02-17                                            | 17.4                                                                 | 3.4         | 0.282639                                  | 0.000028        | 0.001020                                  | 0.282638                                     | -5.2                       | 1.0                                           | -3.8                       | 65          |
| RB12-02-63                                            | 11.8                                                                 | 4.4         | 0.282795                                  | 0.000031        | 0.000736                                  | 0.282794                                     | 0.3                        | 1.1                                           | 1.8                        | 66          |
| RB12-02-47                                            | 6.7                                                                  | 4.1         | 0.282850                                  | 0.000034        | 0.000476                                  | 0.282850                                     | 2.3                        | 1.2                                           | 3.8                        | 67          |
| RB12-02-66                                            | 12.8                                                                 | 3.6         | 0.282740                                  | 0.000038        | 0.000849                                  | 0.282739                                     | -1.6                       | 1.3                                           | -0.1                       | 69          |
| RB12-02-87                                            | 5.8                                                                  | 3.5         | 0.282861                                  | 0.000035        | 0.000332                                  | 0.282861                                     | 2.7                        | 1.2                                           | 4.2                        | 69          |
| RB12-02-14                                            | 22.3                                                                 | 4.8         | 0.282793                                  | 0.000032        | 0.001473                                  | 0.282791                                     | 0.3                        | 1.1                                           | 1.8                        | 70          |
| RB12-02-80                                            | 17.6                                                                 | 3.9         | 0.282797                                  | 0.000031        | 0.001051                                  | 0.282796                                     | 0.4                        | 1.1                                           | 2.0                        | 72          |
| RB12-02-27                                            | 24.7                                                                 | 5.1         | 0.282911                                  | 0.000030        | 0.001828                                  | 0.282909                                     | 4.5                        | 1.0                                           | 6.0                        | 74          |
| RB12-02-18                                            | 17.7                                                                 | 3.5         | 0.282725                                  | 0.000037        | 0.001092                                  | 0.282723                                     | -2.1                       | 1.3                                           | -0.5                       | 76          |
| <b>Sample RB12-04, Orca Fm (59.97959, -149.29672)</b> |                                                                      |             |                                           |                 |                                           |                                              |                            |                                               |                            |             |
| RB12-04-53                                            | 18.0                                                                 | 3.2         | 0.282768                                  | 0.000029        | 0.001077                                  | 0.282767                                     | -0.6                       | 1.0                                           | 0.8                        | 65          |
| RB12-04-26                                            | 8.4                                                                  | 3.3         | 0.282876                                  | 0.000027        | 0.000521                                  | 0.282876                                     | 3.2                        | 1.0                                           | 4.8                        | 70          |
| RB12-04-06                                            | 12.3                                                                 | 3.4         | 0.282700                                  | 0.000038        | 0.000830                                  | 0.282699                                     | -3.0                       | 1.3                                           | -1.5                       | 70          |
| RB12-04-78                                            | 10.5                                                                 | 3.4         | 0.282811                                  | 0.000031        | 0.000645                                  | 0.282811                                     | 0.9                        | 1.1                                           | 2.5                        | 71          |
| RB12-04-25                                            | 14.0                                                                 | 3.3         | 0.282923                                  | 0.000029        | 0.000886                                  | 0.282922                                     | 4.9                        | 1.0                                           | 6.5                        | 73          |
| RB12-04-52                                            | 15.4                                                                 | 3.1         | 0.282906                                  | 0.000040        | 0.001028                                  | 0.282905                                     | 4.3                        | 1.4                                           | 5.9                        | 73          |
| RB12-04-07                                            | 24.1                                                                 | 3.2         | 0.282546                                  | 0.000031        | 0.001524                                  | 0.282544                                     | -8.4                       | 1.1                                           | -6.9                       | 73          |
| RB12-04-28                                            | 60.2                                                                 | 2.8         | 0.282709                                  | 0.000040        | 0.003422                                  | 0.282704                                     | -2.7                       | 1.4                                           | -1.2                       | 74          |
| RB12-04-02                                            | 14.5                                                                 | 3.3         | 0.282858                                  | 0.000033        | 0.000949                                  | 0.282857                                     | 2.6                        | 1.2                                           | 4.2                        | 74          |
| RB12-04-33                                            | 11.1                                                                 | 3.0         | 0.283000                                  | 0.000027        | 0.000828                                  | 0.282999                                     | 7.6                        | 1.0                                           | 9.4                        | 82          |
| RB12-04-77                                            | 16.7                                                                 | 3.6         | 0.282666                                  | 0.000030        | 0.001014                                  | 0.282654                                     | -4.2                       | 1.1                                           | 9.2                        | 618         |
| RB12-04-107                                           | 16.6                                                                 | 4.1         | 0.282265                                  | 0.000034        | 0.000992                                  | 0.282244                                     | -18.4                      | 1.2                                           | 5.2                        | 1085        |
| RB12-04-29                                            | 6.8                                                                  | 3.0         | 0.281716                                  | 0.000026        | 0.000410                                  | 0.281703                                     | -37.8                      | 0.9                                           | 0.6                        | 1726        |
| RB12-04-111                                           | 9.9                                                                  | 4.4         | 0.281328                                  | 0.000035        | 0.000571                                  | 0.281309                                     | -51.5                      | 1.2                                           | -11.9                      | 1788        |
| RB12-04-109                                           | 12.6                                                                 | 3.1         | 0.281432                                  | 0.000030        | 0.000741                                  | 0.281402                                     | -47.9                      | 1.1                                           | -2.0                       | 2073        |
| RB12-04-106                                           | 21.4                                                                 | 3.7         | 0.281567                                  | 0.000039        | 0.001198                                  | 0.281520                                     | -43.1                      | 1.4                                           | 2.3                        | 2081        |
| RB12-04-112                                           | 15.3                                                                 | 3.0         | 0.280858                                  | 0.000027        | 0.000863                                  | 0.280817                                     | -68.1                      | 0.9                                           | -12.0                      | 2538        |
| RB12-04-102                                           | 9.9                                                                  | 3.4         | 0.281079                                  | 0.000031        | 0.000553                                  | 0.281051                                     | -60.3                      | 1.1                                           | -2.3                       | 2597        |