## Supplementary Data 3. 40Ar/39Ar age recalculations

 40Ar/39Ar ages were calculated using a 28.201 ± 0.046 Ma monitor age for the Fish Canyon Tuff sanidine14. Previous 40Ar/39Ar dates5,7,11 used a 28.02 ± 0.28 Ma monitor age for the Fish Canyon Tuff sanidine. Ages were calculated used the following decay constants: l (40K)e = 5.810 x 10-11 ± 3.4 x10-12 yr-1 (value from ref. 44 and errors ref. 45, l(40K)b= 4.962 x 10-10 ± 1.7 x 10-11 yr -1 (ref. 46), yielding l (40K)tot = 5.543 x 10-10 ± 1.73 x 10-11 yr -1. 40Ar/39Ar age recalculations (Table A.1) were made using a simplified Eq. 2 from Mercer and Hodges47:

$$t= \frac{1}{λ}ln⁡\left[\frac{e^{λt\_{m}}-1}{e^{λt\_{m\_{0}}}-1}\* \left(e^{λt\_{0}}-1\right)+1\right]$$

where *t* is the recalculated 40Ar/39 age, λ is l (40K)tot = 5.543 x 10-10, *tm* is the new monitor age, *tm0* is the legacy monitor age, *t0* is the legacy 40Ar/39Ar age, using the same decay constant (l) to calculate the legacy and new 40Ar/39Ar ages. Uncertainty propagation used Eq. B.2 and B.3a – B.3g from Mercer and Hodges47.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sample | Unit | Legacy 40Ar/39Arage (Ma) | ±(Ma) | New40Ar/39Ar age (Ma) | a | ∂t/t0 | h' | ∂t/λ | g | ∂t/tm0 | g' | ∂t/tm | s t (Ma) |
|  |  |  |  | Eq. 2 | Eq. B3a | Eq. B3a | Eq. B3c | Eq. B3d | Eq. B3d | Eq. B3d | Eq. B3e | Eq. B3e | Eq. B2 |
| YJB99.87 | BaytMawjan Ig. | 27.67 (1) | 0.12 | 27.85 | 1.00 | 1.00 | 9.80 x10-6 | 3.96 x 108 | 2.42 x10-10 | -1.00 x10-6 | 9.80 x10-6 | 9.95 x10-6 | 0.12 |
| BM1 | Ig. | 28.00 (2) | 0.10 | 28.18 | 1.00 | 1.00 | 9.92 x10-7 | 4.01 x 108 | 2.45 x10-10 | -1.01 x10-6 | 9.92 x10-6 | 1.01 x10-6 | 0.10 |
| BM5 | Tuff | 28.40 (2) | 0.14 | 28.58 | 1.00 | 1.00 | 1.01 x10-6 | 4.07 x 108 | 2.48 x10-10 | -1.03 x10-6 | 1.01 x10-6 | 1.02 x10-6 | 0.14 |
| YJB88.79 | Iftar Alkalb | 29.48 (1) | 0.08 | 29.67 | 1.00 | 1.00 | 1.04 x10-6 | 4.22 x 108 | 2.57 x10-10 | -1.07 x10-6 | 1.04 x10-6 | 1.06 x10-6 | 0.08 |
| YJB99.76 | GreenTuff | 29.59 (2) | 0.12 | 29.78 | 1.00 | 1.00 | 1.05 x10-6 | 4.24 x 108 | 2.58 x10-10 | -1.07 x10-6 | 1.05 x10-6 | 1.06 x10-6 | 0.12 |
| YJB99.72 | AkrabanAndesite | 29.61 (2) | 0.08 | 29.80 | 1.00 | 1.00 | 1.05 x10-6 | 4.24 x 108 | 2.59 x10-10 | -1.07 x10-6 | 1.05 x10-6 | 1.07 x10-6 | 0.08 |
| YJB99.13 | Kura’abasalt | 30.03 (2) | 0.26 | 30.22 | 1.00 | 1.00 | 1.06 x10-6 | 4.30 x 108 | 2.62 x10-10 | -1.09 x10-6 | 1.06 x10-6 | 1.08 x10-6 | 0.26 |
| EIU99-035 | ShibamKawkabam Ig. | 30.16 (3) | 0.13 | 30.35 | 1.00 | 1.00 | 1.07 x10-6 | 4.32 x 108 | 2.63 x10-10 | -1.09 x10-6 | 1.07 x10-6 | 1.08 x10-6 | 0.13 |

Supplementary Table 1. Details on the 40Ar/39Ar age uncertainty propagation. Legacy 40Ar/39Ar ages are from (1) Riisager et al.5, (2) Baker et al.11, and (3) Ukstins et al.7. Equations are from Mercer and Hodges47.