**Table 1**
Chemical and He-C-N isotopic compositions of hydrothermal volatiles from Lhasa terrane, southern Tibet

| Sample No. | Locality | T | $N_2$ | $O_2$ | Ar | $CO_2$ | $CH_4$ | He | $^4He/^{20}Ne$ | $^3He/^4He$ | $R_M/R_A$ | Error | $R_C/R_A$ | $\delta^{13}C$ | $CO_2/^3He$ | $\delta^{15}N$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (°C) | (%) | (%) | (%) | (%) | (%) | (ppm) | | | | (1σ) | | (‰) | ($\times10^9$) | (‰) |
| 20CW01 | Cawu | 64 | 38.90 | 0.8 | 0.44 | 59.7 | 0.1 | 6615 | 1132 | 3.3E-08 | 0.024 | 0.004 | 0.024 | -7.1 | 2.7 | 1.5 |
| 20CW01-R | Cawu | 64 | – | – | – | – | – | 6904 | 1867 | 3.2E-08 | 0.023 | 0.003 | 0.023 | – | – | – |
| 20DSC01 | Dongsong Co | 18 | 86.10 | 0.15 | 0.63 | 13.1 | 0.01 | 848 | 1100 | 2.3E-08 | 0.016 | 0.002 | 0.016 | -7.4 | 6.8 | 1.5 |
| 20BD01 | Buduo | 51 | 2.10 | 0.38 | 0.03 | 97.5 | 0 | 15 | 41 | 3.4E-08 | 0.025 | 0.004 | 0.018 | -6.6 | 1894.8 | -0.1 |
| 20BL01 | Biela | 60 | 13.90 | 2.62 | 0.19 | 83.3 | 0.01 | 103 | 53 | 9.6E-07 | 0.687 | 0.069 | 0.685 | -3.3 | 8.5 | -1.1 |
| 20BL01-R | Biela | 60 | – | – | – | – | – | 126 | 51 | 8.0E-07 | 0.576 | 0.058 | 0.573 | – | – | – |
| 20CZ01 | Chazi | 73 | 27.20 | 3.86 | 0.34 | 68.6 | 0.07 | 2166 | 1027 | 2.8E-08 | 0.020 | 0.003 | 0.020 | -4.3 | 11.3 | 3.1 |
| 20WB01 | Wenbu | 54 | 5.50 | 1.46 | 0.08 | 93 | 0.03 | 4 | 6 | 1.3E-06 | 0.899 | 0.09 | 0.895 | -2.6 | 201.0 | -0.2 |
| 20ZBQK01 | Zhongbaquku | 58 | 21.20 | 2 | 0.3 | 76.5 | 0.02 | 2092 | 692 | 2.1E-08 | 0.015 | 0.002 | 0.015 | -5.7 | 17.2 | 0.0 |
| 20ZBQK01-R | Zhongbaquku | 58 | – | – | – | – | – | 2146 | 666 | 2.7E-08 | 0.019 | 0.003 | 0.019 | – | – | – |
| 20DMX01 | Damuxia | 33 | 10.70 | 3.11 | 0.14 | 86 | 0 | 23 | 43 | 7.5E-08 | 0.054 | 0.008 | 0.048 | -4.9 | 500.1 | -0.3 |
| 20QD01 | Qingdu | 72 | 6.90 | 1.65 | 0.09 | 91.4 | 0 | 116 | 150 | 1.2E-07 | 0.085 | 0.009 | 0.083 | -4.0 | 66.7 | -0.7 |
| 20QD01-R | Qingdu | 58 | – | – | – | – | – | 113 | 94 | 1.4E-07 | 0.099 | 0.01 | 0.097 | – | – | – |
| 20CDQZ01 | Chaduoquzeng | 39 | 4.90 | 0.28 | 0.05 | 94.7 | 0.01 | 726 | 823 | 1.3E-07 | 0.094 | 0.009 | 0.093 | -1.8 | 10.0 | 0.3 |
| 20MSL01 | Musile | 59 | 7.00 | 2.28 | 0.11 | 90.7 | 0 | 6 | 7 | 3.4E-07 | 0.243 | 0.024 | 0.215 | -2.6 | 470.6 | 0.0 |
| 20MD01 | Mudi | 77 | 25.10 | 6.65 | 0.34 | 67.9 | 0.04 | 20 | 14 | 3.7E-07 | 0.265 | 0.027 | 0.251 | -3.7 | 92.2 | 1.3 |
| 20PD01 | Pudui | 59 | 16.00 | 4.16 | 0.19 | 79.7 | 0 | 34 | 17 | 9.0E-08 | 0.065 | 0.01 | 0.050 | -2.5 | 261.0 | 0.0 |
| 20LZ01 | Luozha | 68 | – | – | – | – | – | 993 | 532 | 2.2E-07 | 0.155 | 0.016 | 0.155 | -3.1 | 3.6 | 0.1 |
| 20LZ02 | Luozha | 68 | 18.30 | 4.86 | 0.22 | 76.7 | 0 | 7 | 8 | 2.7E-07 | 0.191 | 0.019 | 0.163 | -3.8 | 411.7 | – |

**Table 2.** Summary of input parameters and output results for Monte Carlo simulations

| Volcanic fields | Chazi | 1σ | Mibale | 1σ | Yaqian | 1σ | Garwa | 1σ |
|---|---|---|---|---|---|---|---|---|
| Input parameters | | | | | | | | |
| $(R_A)_{initial}$ | | | | $8 \pm 1$ | | | | |
| $(^4He)_{initial}$ ($cm^3/g$) | | | | $3\ (\pm 2) \times 10^{-6}$ | | | | |
| Age (Ma) [a] | 10.9 | 2.19 | 15.3 | 3.35 | 13.5 | 0.41 | 21.2 | 2.33 |
| Degree (BPM) [a] | 0.1 | 0.02 | 0.08 | 0.016 | 0.02 | 0.004 | 0.01 | 0.002 |
| Th (Rock, ppm) [a] | 189.8 | 63.1 | 124.3 | 26.7 | 173.9 | 2.1 | 238.7 | 48.8 |
| U (Rock, ppm) [a] | 23.9 | 10.5 | 17.3 | 5.3 | 16.5 | 0.9 | 22.1 | 5.2 |
| Output Parameters 1 | | | | | | | | |
| $Th_0$ (Mantle, ppm) [b] | 19.0 | 7.5 | 10.0 | 2.9 | 3.6 | 0.7 | 2.5 | 0.71 |
| $U_0$ (Mantle, ppm) [b] | 2.4 | 1.2 | 1.4 | 0.52 | 0.35 | 0.07 | 0.24 | 0.07 |
| $J_{4He}$ (Mantle, $cm^3/g/yr$) [b] | 8.4E-13 | 2.6E-13 | 4.6E-13 | 1.0E-3 | 1.5E-13 | 2.2E-14 | 1.0E-13 | 2.2E-14 |
| Output Parameters 2 | | | | | | | | |
| $(R_A)_{final}$ [c] | 2.0 | 1.4 | 2.4 | 0.9 | 4.6 | 1.2 | 4.5 | 1.3 |

*Note.* **a.** Average values and 1 standard deviation (1σ) of eruptive age, Th and U contents of ultrapotassic rocks are calculated from Guo et al (2013) and references therein, the batch partial melting (BPM) degree in different volcanic fields are from the trace element simulations in Guo et al (2013), and 20% uncertainties are assumed. **b.** Calculated results (Ave. and 1σ) from Monte Carlo simulations with the number of realizations and random generator seeds of $10^5$ and 38, respectively. **c.** Calculated the theoretical highest $^3He/^4He$ $(R_A)_{final}$ with the average eruptive age of different volcanic fields, respectively, when assuming the systems are closed.

Data source:

Guo, Z., Wilson, M., Zhang, M., Cheng, Z., & Zhang, L. (2013). Post-collisional, K-rich mafic magmatism in South Tibet: constraints on Indian slab–to–wedge transport processes and plateau uplift. *Contribions to Mineralogy and Petrology, 165*, 1311–1340.