

Приложения 2.1-2.2

Геохимия и геохронология палеопротерозойских кварцевых монцогаббро–монцодиорит–гранодиоритов плутона Потудань, Волго-Донской ороген*Петракова Марина Евгеньевна, Терентьев Роман Анатольевич, Юрченко Анастасия Владимировна, Савко Константин Аркадьевич***Приложение 2.1.** Содержание петрогенных оксидов (мас. %) и концентрации редких и рассеянных элементов (ppm) представительных образцов пород потуданского, павловского и гибридного типов.

| Порода | Плутон Потудань | | | | | | | Гибридная порода | Павловский комплекс | | |
|--------------------------------|-----------------|---------|---------|---------|---------|---------|---------|------------------|---------------------|-------|-------|
| | Qtz MGb | Qtz MGb | Qtz MGb | Qtz MGD | Qtz MGD | Qtz MGD | Qtz MDi | Gd | Qtz MDi | Gd | Gd |
| Скв. | 8003 | 6418 | 6438 | 8003 | 8003 | 6427 | 8003 | 8003 | 8003 | 6420 | 6432 |
| глуб.м. | 255.0 | 66.0 | 73.5 | 145.0 | 400.0 | 75 | 365 | 190.0 | 295.0 | 64.0 | 86.7 |
| SiO ₂ | 49.05 | 50.26 | 50.58 | 51.8 | 52.91 | 55.14 | 58.01 | 63.95 | 60.95 | 62.8 | 67.89 |
| TiO ₂ | 2.01 | 2.28 | 1.69 | 2.17 | 2.21 | 1.93 | 1.26 | 0.45 | 0.92 | 0.79 | 0.34 |
| Al ₂ O ₃ | 14.09 | 13.71 | 14.59 | 13.88 | 13.22 | 14.72 | 14.34 | 15.77 | 14.68 | 15.53 | 13.56 |
| Fe ₂ O ₃ | 13.89 | 13.49 | 12.52 | 12.76 | 11.91 | 10.16 | 8.72 | 6.25 | 7.11 | 5.04 | 5.71 |
| MnO | 0.14 | 0.13 | 0.12 | 0.14 | 0.12 | 0.11 | 0.08 | 0.09 | 0.10 | 0.05 | 0.07 |
| MgO | 6.11 | 3.49 | 3.77 | 3.36 | 4.26 | 3.04 | 2.89 | 1.45 | 2.76 | 1.37 | 0.81 |
| CaO | 6.64 | 7.36 | 6.84 | 6.85 | 7.18 | 4.80 | 6.35 | 3.97 | 5.44 | 3.46 | 3.70 |
| Na ₂ O | 2.87 | 3.04 | 3.44 | 3.14 | 2.8 | 3.42 | 3.70 | 4.70 | 3.53 | 3.81 | 3.84 |
| K ₂ O | 3.27 | 3.60 | 3.07 | 3.65 | 3.3 | 4.32 | 3.03 | 2.51 | 3.37 | 5.68 | 3.33 |
| P ₂ O ₅ | 0.84 | 1.42 | 1.22 | 1.22 | 1.50 | 0.89 | 0.70 | 0.26 | 0.33 | 0.43 | 0.22 |
| S | 0.08 | 0.11 | 0.19 | 0.1 | 0.11 | 0.17 | 0.16 | н.п.о. | 0.05 | 0.87 | 0.02 |
| ППП | 0.48 | 0.67 | 1.33 | 0.37 | 0.24 | 0.45 | 0.25 | 0.37 | 0.42 | 0.29 | 0.41 |

| Сумма | 99.46 | 99.55 | 99.37 | 99.42 | 99.74 | 99.16 | 99.47 | 99.76 | 99.66 | 99.33 | 99.9 |
|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|-------|
| V | 173 | 176 | 164 | 148 | 188 | 106 | 108 | 67.4 | 118 | 69.8 | 191 |
| Cr | 196 | 57.3 | 115 | 49.8 | 89.2 | 42.6 | 44.0 | 55.0 | 108 | 56.2 | 64.9 |
| Co | 22.2 | 2.84 | 9.43 | 8.53 | 12.3 | 3.00 | 6.00 | н.п.о. | 11.0 | н.п.о | н.п.о |
| Ni | 60.7 | 22.9 | 30.8 | 24.2 | 48.3 | 12.9 | 27.0 | 15.8 | 34.0 | 5.00 | 8.00 |
| Cu | 42.4 | 21.4 | 26.9 | 20.7 | 39.8 | 21.0 | 20.0 | 4.17 | 10.0 | 6.00 | 1.00 |
| Zn | 111.6 | 80.7 | 123.7 | 140.7 | 185.4 | 139.0 | 76.0 | 85.0 | 73.0 | 59.0 | 59.0 |
| Ga | 19.7 | 24.0 | 22.9 | 22.0 | 21.0 | 25.5 | 17.0 | 22.0 | 18.5 | 23.0 | 23.2 |
| Rb | 75.0 | 82.6 | 85.6 | 86.1 | 80.6 | 50.7 | 53.0 | 66.2 | 118 | 135 | 87 |
| Sr | 723 | 890 | 770 | 785 | 847 | 868 | 755 | 380 | 597 | 628 | 912 |
| Y | 24.1 | 33.2 | 32.5 | 33.1 | 30.1 | 32.0 | 16.0 | 21.8 | 10.6 | 28.9 | 32.8 |
| Zr | 56.3 | 530.1 | 176.2 | 357.1 | 372.7 | 520 | 93.0 | 207.9 | 231 | 301 | 151 |
| Nb | 27.0 | 27.3 | 31.6 | 33.1 | 29.7 | 39.9 | 14.0 | 10.2 | 9.15 | 37.8 | 30.2 |
| Cs | 16.7 | 14.2 | 13.6 | 17.2 | 17.1 | 13.0 | 11.0 | 3.16 | 7.00 | 6.00 | 3.00 |
| Ba | 1340 | 1510 | 1310 | 1340 | 1410 | 3050 | 1920 | 505 | 845 | 2840 | 1370 |
| La | 67.5 | 98.8 | 99.4 | 108 | 93.0 | 106 | 62.1 | 39.1 | 53.5 | 93.0 | 94.3 |
| Ce | 135 | 203 | 198 | 217 | 193 | 220 | 119 | 76.6 | 93.5 | 184 | 190 |
| Pr | 16.3 | 24.7 | 24.3 | 25.6 | 22.6 | 26.9 | 14.5 | 9.18 | 9.38 | 22.1 | 24.1 |
| Nd | 60.7 | 96.1 | 90.5 | 95.1 | 88.9 | 104 | 55.3 | 33.8 | 31.3 | 79.1 | 91.9 |
| Sm | 10.4 | 16.4 | 15.1 | 16.3 | 14.8 | 17.2 | 9.39 | 6.53 | 4.68 | 12.9 | 15.9 |
| Eu | 2.36 | 3.59 | 3.03 | 3.46 | 2.94 | 3.99 | 2.97 | 1.28 | 1.34 | 3.01 | 3.22 |
| Gd | 8.01 | 12.0 | 11.1 | 13.0 | 11.2 | 11.50 | 7.08 | 5.44 | 3.87 | 9.41 | 11.5 |
| Tb | 0.99 | 1.57 | 1.51 | 1.56 | 1.45 | 1.48 | 0.89 | 0.79 | 0.50 | 1.24 | 1.51 |
| Dy | 5.09 | 7.14 | 6.81 | 6.69 | 6.56 | 6.97 | 4.49 | 4.36 | 2.36 | 6.22 | 6.97 |
| Ho | 0.81 | 1.23 | 1.20 | 1.23 | 1.17 | 1.18 | 0.78 | 0.73 | 0.43 | 1.09 | 1.13 |
| Er | 2.18 | 3.35 | 3.22 | 3.24 | 2.92 | 2.97 | 1.98 | 2.09 | 0.96 | 2.80 | 3.23 |
| Tm | 0.28 | 0.40 | 0.46 | 0.44 | 0.35 | 0.40 | 0.26 | 0.27 | 0.14 | 0.42 | 0.43 |
| Yb | 1.65 | 2.57 | 2.35 | 2.49 | 2.25 | 2.42 | 1.56 | 1.38 | 0.80 | 2.43 | 2.50 |
| Lu | 0.26 | 0.37 | 0.35 | 0.34 | 0.35 | 0.37 | 0.21 | 0.22 | 0.15 | 0.34 | 0.34 |

| | | | | | | | | | | | |
|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Hf | 2.29 | 10.4 | 4.18 | 8.41 | 8.26 | 16.0 | 3.51 | 5.57 | 5.35 | 14.9 | 7.97 |
| Ta | 1.38 | 1.51 | 1.49 | 1.69 | 1.50 | 2.11 | 1.09 | 0.37 | 0.33 | 1.42 | 1.51 |
| Th | 6.47 | 7.20 | 6.34 | 7.74 | 7.50 | 4.83 | 8.74 | 3.53 | 12.4 | 8.37 | 7.08 |
| U | 1.15 | 1.40 | 0.98 | 1.08 | 1.21 | 1.38 | 1.95 | 0.92 | 2.01 | 1.58 | 1.46 |
| ΣREE | 311.5 | 471.2 | 457.3 | 494.5 | 441.5 | 505.4 | 280.5 | 181.8 | 202.9 | 418.1 | 447.0 |
| (La/Yb) _n | 27.6 | 25.9 | 28.5 | 29.2 | 27.9 | 29.5 | 26.8 | 19.1 | 45.1 | 25.8 | 25.4 |
| (Gd/Yb) _n | 3.9 | 3.8 | 3.8 | 4.2 | 4.0 | 3.8 | 3.7 | 3.2 | 3.9 | 3.1 | 3.7 |
| Eu/Eu* | 0.76 | 0.75 | 0.69 | 0.70 | 0.67 | 0.82 | 1.07 | 0.64 | 0.94 | 0.80 | 0.70 |
| Th/Yb | 3.92 | 2.80 | 2.70 | 3.11 | 3.33 | 2.00 | 5.60 | 2.56 | 15.50 | 3.44 | 2.83 |
| Ta/Yb | 0.84 | 0.59 | 0.63 | 0.68 | 0.67 | 0.87 | 0.70 | 0.27 | 0.41 | 0.58 | 0.60 |

Примечания: Qtz MGb – кварцевое монцогаббро, Qtz MGD – кварцевый монцогаббродиорит, Qtz MDi – кварцевый монцодиорит, Gd – гранодиорит; н.п.о. – ниже предела обнаружения. Содержания петрогенных элементов из работы (Петракова и Терентьев, 2018)

Приложение 2.2. Результаты U-Pb исследований цирконов из кварцевого монцонаббро плутона Потудань (скв. 6418).

| Номер P анализа | $^{206}\text{Pb}_c$, % | U ppm | Th ppm | ^{232}Th $/^{238}\text{U}$ | ^{206}Pb * ppm | (1)Возраст ^{206}Pb $/^{238}\text{U}$ млн.лет | (1)Возраст $^{207}\text{Pb}/^{206}\text{Pb}$ млн.лет | D, % | (1) $^{238}\text{U}/^{206}\text{Pb}$ Pb* | ±% | (1) $^{207}\text{Pb}^*$ $/^{206}\text{Pb}^*$ | ±% | (1) $^{207}\text{Pb}^*$ $/^{235}\text{U}^*$ | ±% | (1) $^{206}\text{Pb}^*$ $/^{238}\text{U}$ | ±% | корре- ляция ошибок |
|-----------------------|-------------------------|----------|-----------|--|-------------------------------|---|--|------|--|-------|--|------|---|-----|---|-----|---------------------------|
| 2.1 | 0.06 | 213 | 459 | 2.23 | 66.5 | 1997 ±29 | 2061 ± 9.9 | 3 | 2.753 | ± 9.9 | 0.13 | 0.56 | 6.37 | 1.8 | 0.363 | 1.7 | 0.948 |
| 4.1 | 0.04 | 469 | 568 | 1.25 | 147.0 | 2001 ±28 | 2053 ± 6.9 | 3 | 2.748 | ± 6.9 | 0.13 | 0.39 | 6.36 | 1.7 | 0.364 | 1.6 | 0.972 |
| 8.1 | 0.01 | 217 | 451 | 2.15 | 68.2 | 2010 ±29 | 2067 ±10 | 3 | 2.733 | ±10 | 0.13 | 0.57 | 6.44 | 1.8 | 0.366 | 1.7 | 0.946 |
| 9.1 | 0.00 | 312 | 841 | 2.79 | 98.5 | 2018 ±29 | 2046 ± 8.6 | 1 | 2.721 | ± 8.6 | 0.13 | 0.49 | 6.40 | 1.7 | 0.368 | 1.7 | 0.959 |
| 4.2 | 0.02 | 395 | 168 | 0.44 | 125.0 | 2024 ±29 | 2071 ± 7.4 | 2 | 2.710 | ± 7.4 | 0.13 | 0.42 | 6.51 | 1.7 | 0.369 | 1.6 | 0.969 |
| 12.1 | 0.10 | 66 | 104 | 1.63 | 21.0 | 2030 ±31 | 2084 ±19 | 3 | 2.701 | ±19 | 0.13 | 1.10 | 6.58 | 2.1 | 0.370 | 1.8 | 0.857 |
| 11.2 | 0.02 | 297 | 258 | 0.9 | 94.8 | 2038 ±29 | 2062 ± 8.7 | 1 | 2.690 | ± 8.7 | 0.13 | 0.49 | 6.53 | 1.7 | 0.372 | 1.7 | 0.959 |
| 1.1 | 0.17 | 85 | 76 | 0.93 | 27.2 | 2040 ±30 | 2034 ±27 | 0 | 2.686 | ±27 | 0.13 | 1.60 | 6.44 | 2.3 | 0.372 | 1.7 | 0.747 |
| 11.1 | 0.02 | 105 | 196 | 1.94 | 33.7 | 2052 ±30 | 2088 ±14 | 2 | 2.668 | ±14 | 0.13 | 0.82 | 6.68 | 1.9 | 0.375 | 1.7 | 0.904 |
| 14.1 | 0.03 | 89 | 147 | 1.72 | 28.6 | 2053 ±32 | 2057 ±16 | 0 | 2.666 | ±16 | 0.13 | 0.90 | 6.57 | 2.0 | 0.375 | 1.8 | 0.896 |
| 7.1 | 0.09 | 201 | 401 | 2.06 | 64.9 | 2058 ±30 | 2052 ±11 | 0 | 2.660 | ±11 | 0.13 | 0.62 | 6.57 | 1.8 | 0.376 | 1.7 | 0.937 |
| 6.1 | 0.03 | 83 | 130 | 1.62 | 26.7 | 2060 ±32 | 2049 ±16 | -1 | 2.656 | ±16 | 0.13 | 0.92 | 6.56 | 2.0 | 0.377 | 1.8 | 0.891 |
| 5.1 | 0.06 | 146 | 288 | 2.03 | 47.4 | 2062 ±30 | 2049 ±16 | -1 | 2.653 | ±16 | 0.13 | 0.90 | 6.57 | 1.9 | 0.377 | 1.7 | 0.885 |
| 10.1 | 0.00 | 298 | 672 | 2.33 | 96.6 | 2062 ±30 | 2070 ± 8.7 | 0 | 2.652 | ± 8.7 | 0.13 | 0.50 | 6.65 | 1.7 | 0.377 | 1.7 | 0.959 |
| 3.1 | 0.29 | 201 | 287 | 1.48 | 65.4 | 2067 ±30 | 2089 ±17 | 1 | 2.646 | ±17 | 0.13 | 0.98 | 6.74 | 2.0 | 0.378 | 1.7 | 0.869 |
| 14.2 | 0.03 | 74 | 108 | 1.52 | 24.0 | 2072 ±32 | 2046 ±18 | -1 | 2.639 | ±18 | 0.13 | 1.00 | 6.60 | 2.1 | 0.379 | 1.8 | 0.865 |
| 13.1 | 0.13 | 40 | 52 | 1.33 | 13.3 | 2100 ±34 | 2079 ±25 | -1 | 2.596 | ±25 | 0.13 | 1.40 | 6.83 | 2.4 | 0.385 | 1.9 | 0.805 |

Примечание: Pb_c и Pb^* общий и радиогенный свинец; (1) коррекция на Pb_c по измеренному ^{204}Pb ; D, % дискордантность $100 \times \{(\text{возраст } ^{207}\text{Pb}/^{206}\text{Pb}) / (\text{возраст } ^{206}\text{Pb}/^{238}\text{U}) - 1\}$; ошибки калибровки – 0,50; анализы выполнены в Центре изотопных исследований ВСЕГЕИ, аналитик: Н.В. Родионов.