Table 1. Whole rock compositions of the amphibolites in the Muju area.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Rock type | type-I amphibolite | | |  | type-II amphibolite | | |
| sample No. | MJ0327-8A | MJ0327-8B | MJ1012-1 |  | MJ0325-4A | MJ0327-9 | MJ1012-3 |
| FeO | 10.300 | 10.100 | 9.900 |  | 6.500 | 6.600 | 8.600 |
| SiO2 | 49.170 | 49.740 | 49.220 |  | 50.250 | 53.970 | 52.570 |
| Al2O3 | 12.960 | 12.790 | 13.610 |  | 16.520 | 13.850 | 13.730 |
| Fe2O3(T) | 12.260 | 12.230 | 12.240 |  | 9.410 | 7.970 | 9.630 |
| MnO | 0.181 | 0.179 | 0.183 |  | 0.269 | 0.151 | 0.164 |
| MgO | 9.500 | 9.460 | 9.200 |  | 5.840 | 9.990 | 8.760 |
| CaO | 11.370 | 11.140 | 10.590 |  | 7.790 | 5.700 | 9.560 |
| Na2O | 1.740 | 1.960 | 2.240 |  | 3.160 | 2.360 | 2.230 |
| K2O | 0.880 | 0.830 | 0.700 |  | 1.720 | 2.050 | 0.590 |
| TiO2 | 0.860 | 0.824 | 0.763 |  | 1.288 | 0.822 | 0.643 |
| P2O5 | 0.070 | 0.060 | 0.060 |  | 0.210 | 0.120 | 0.110 |
| LOI | 1.550 | 1.480 | 2.040 |  | 3.350 | 2.490 | 1.840 |
| Total | 100.500 | 100.700 | 100.800 |  | 99.810 | 99.470 | 99.830 |
| Trace elements (ppm) | |  |  |  |  |  |  |
| Sc | 41 | 41 | 44 |  | 29 | 24 | 21 |
| V | 299 | 283 | 298 |  | 176 | 185 | 126 |
| Cr | 520 | 500 | 800 |  | 560 | 170 | 760 |
| Ni | 160 | 150 | 260 |  | 120 | 30 | 140 |
| Ga | 13 | 14 | 12 |  | 15 | 19 | 16 |
| Rb | 41 | 36 | 31 |  | 22 | 88 | 127 |
| Sr | 89 | 98 | 155 |  | 215 | 622 | 319 |
| Y | 16 | 16 | 17 |  | 22 | 19 | 17 |
| Zr | 45 | 48 | 35 |  | 84 | 117 | 122 |
| Nb | 2 | 2 | 2 |  | 4 | 8 | 5 |
| Cs | 1.00 | 0.80 | 1.20 |  | 1.30 | 2.40 | 9.40 |
| Ba | 44 | 45 | 39 |  | 358 | 404 | 325 |
| La | 3.50 | 3.50 | 3.90 |  | 14.50 | 17.00 | 18.90 |
| Ce | 8.70 | 8.60 | 8.40 |  | 32.80 | 35.50 | 37.70 |
| Pr | 1.36 | 1.36 | 1.32 |  | 3.89 | 4.20 | 4.50 |
| Nd | 6.70 | 6.70 | 6.20 |  | 15.40 | 17.80 | 17.90 |
| Sm | 2.10 | 2.10 | 2.00 |  | 3.40 | 3.70 | 3.90 |
| Eu | 0.83 | 0.79 | 0.66 |  | 1.22 | 1.27 | 1.12 |
| Gd | 2.80 | 3.00 | 2.70 |  | 3.60 | 3.90 | 3.80 |
| Tb | 0.50 | 0.50 | 0.50 |  | 0.60 | 0.60 | 0.60 |
| Dy | 3.00 | 3.00 | 3.10 |  | 3.60 | 3.80 | 3.60 |
| Ho | 0.60 | 0.60 | 0.60 |  | 0.70 | 0.70 | 0.70 |
| Er | 1.70 | 1.70 | 1.90 |  | 2.15 | 1.90 | 2.00 |
| Tm | 0.23 | 0.24 | 0.27 |  | 0.31 | 0.27 | 0.30 |
| Yb | 1.50 | 1.50 | 1.70 |  | 2.15 | 1.70 | 2.00 |
| Lu | 0.23 | 0.22 | 0.28 |  | 0.33 | 0.26 | 0.30 |
| Hf | 1.20 | 1.20 | 1.00 |  | 2.20 | 3.10 | 3.30 |
| Ta | 0.20 | 0.20 | 0.30 |  | 0.30 | 0.60 | 0.30 |
| Pb | 8.00 | 8.00 | 5.00 |  | 10.00 | 16.00 | 9.00 |
| Th | 0.50 | 0.90 | 0.40 |  | 1.70 | 2.70 | 4.60 |
| U | 0.80 | 0.90 | 1.10 |  | 0.60 | 0.60 | 1.00 |
|  |  |  |  |  |  |  |  |
| (La/Yb)N | 1.67 | 1.67 | 1.65 |  | 4.84 | 7.17 | 6.78 |
| Eu/Eu\* | 1.05 | 0.96 | 0.87 |  | 1.07 | 1.02 | 0.89 |

(La/Yb)N : chondrite (Sun and Mcdonough, 1989)-normalized value.

Eu/Eu\* = EuN/

Table 2. The P–T conditions estimated from the migmatite and amphibolite in the Muju area using conventional geothermobarometry.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rock type |  | Migmatite | | | | | | | |  | Amphibolite | | |
| Sampel No. |  | MJ111 | |  | MJ2510 | |  | MJ112 | |  | MJ0327-8 | | |
| location |  | rim | rim |  | rim | rim |  | rim | rim |  |  |  |  |
| Grt | Fe | 2.47 | 2.52 |  | 2.48 | 2.53 |  | 2.48 | 2.45 |  |  |  |  |
|  | Mg | 0.38 | 0.34 |  | 0.21 | 0.20 |  | 0.23 | 0.19 |  |  |  |  |
|  | Ca | 0.10 | 0.10 |  | 0.11 | 0.10 |  | 0.09 | 0.10 |  |  |  |  |
|  | Mn | 0.09 | 0.07 |  | 0.21 | 0.20 |  | 0.25 | 0.28 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| location |  | contact with grt | |  | contact with grt | |  | contact with grt | |  |  |  |  |
| Bt | Fe | 2.52 | 2.35 |  | 2.60 | 2.60 |  | 2.63 | 2.81 |  |  |  |  |
|  | Mg | 1.80 | 2.01 |  | 1.99 | 1.91 |  | 2.05 | 1.91 |  |  |  |  |
|  | Al(VI) | 1.05 | 1.01 |  | 0.91 | 0.97 |  | 1.13 | 1.11 |  |  |  |  |
|  | Ti | 0.19 | 0.25 |  | 0.18 | 0.17 |  | 0.01 | 0.01 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| location |  |  |  |  |  |  |  |  |  |  | contact with pl | | |
| Amp | Fe |  |  |  |  |  |  |  |  |  | 2.282 | 2.305 | 2.296 |
|  | Mg |  |  |  |  |  |  |  |  |  | 3.698 | 3.779 | 3.917 |
|  | Al |  |  |  |  |  |  |  |  |  | 1.861 | 1.871 | 1.778 |
|  | Ti |  |  |  |  |  |  |  |  |  | 0.148 | 0.117 | 0.041 |
|  | Ca |  |  |  |  |  |  |  |  |  | 1.845 | 1.907 | 1.935 |
|  | Na |  |  |  |  |  |  |  |  |  | 0.294 | 0.302 | 0.283 |
|  | K |  |  |  |  |  |  |  |  |  | 0.217 | 0.191 | 0.194 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| location |  | contact with grt | |  | contact with grt | |  | contact with grt | |  | contact with amp | | |
| Pl | Ca | 1.11 | 1.23 |  | 1.19 | 0.95 |  | 1.13 | 1.11 |  | 2.24 | 1.92 | 1.91 |
|  | Na | 2.83 | 2.79 |  | 2.77 | 3.05 |  | 2.85 | 2.83 |  | 1.78 | 2.14 | 2.14 |
|  | K | 0.02 | 0.01 |  | 0.01 | 0.10 |  | 0.01 | 0.02 |  | 0.02 | 0.01 | 0.01 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T(℃) |  | 622 | 571 |  | 520 | 515 |  | 534 | 522 |  | 624 | 627 | 633 |
| P(Kb) |  | 3.5 | 2.3 |  | 2.1 | 1.8 |  | 1.7 | 1.8 |  | 3.1 | 2.8 | 2.9 |