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/$\sqrt{Sm\_{N}\*Gd\_{N}}$

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 |