**表1 大红柳滩地区二云母花岗岩及不同矿化程度伟晶岩中云母主量元素组成(wt.%)**

Table 1. Major element data of mica from two-mica granite and pegmatite in the Dahongliutan area (wt.%)

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 二云母花岗岩 | | | | | 白云母-微斜长石伟晶岩 | | | | | |
| 矿物 | Ms | Ms | Ms | Ms | Ms | Ms | Ms | Ms | Ms | Ms | Ms |
| 编号 | DN35-1-1 | DN35-1-4 | DN35-2-1 | DN35-2-2 | DN35-2-3 | DN5-1-1 | DN5-1-2 | DN5-1-3 | DN5-2-2 | DN5-2-3 | DN5-2-4 |
| SiO2 | 46.48 | 46.52 | 46.71 | 46.86 | 46.57 | 46.17 | 45.65 | 45.00 | 45.65 | 46.05 | 45.67 |
| TiO2 | 0.86 | 0.87 | 0.84 | 0.85 | 0.87 | 0.93 | 0.07 | 0.02 | 0.05 | 0.00 | 0.02 |
| Al2O3 | 35.54 | 35.37 | 35.36 | 34.70 | 35.10 | 35.19 | 36.24 | 36.84 | 36.75 | 36.79 | 36.36 |
| FeO | 1.42 | 1.39 | 1.40 | 1.58 | 1.50 | 1.41 | 1.51 | 1.20 | 1.22 | 1.22 | 1.57 |
| MnO | 0.06 | 0.04 | 0.04 | 0.05 | 0.04 | 0.03 | 0.08 | 0.04 | 0.00 | 0.04 | 0.07 |
| MgO | 0.60 | 0.59 | 0.60 | 0.70 | 0.73 | 0.51 | 0.12 | 0.09 | 0.11 | 0.00 | 0.14 |
| CaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.02 | 0.03 | 0.00 | 0.00 |
| Na2O | 0.37 | 0.31 | 0.36 | 0.45 | 0.49 | 0.36 | 0.53 | 0.33 | 0.38 | 0.61 | 0.30 |
| K2O | 10.13 | 10.04 | 10.03 | 10.16 | 9.95 | 10.31 | 9.95 | 9.84 | 10.12 | 9.74 | 9.92 |
| Rb2O | 0.08 | 0.00 | 0.00 | 0.06 | 0.07 | 0.00 | 0.36 | 0.73 | 0.70 | 0.78 | 0.95 |
| Cs2O | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.07 | 0.00 |
| F | 0.25 | 0.22 | 0.00 | 0.24 | 0.00 | 0.08 | 0.23 | 0.11 | 0.10 | 0.13 | 0.19 |
| Cl | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.01 |
| O=F,Cl | 0.11 | 0.09 | 0.00 | 0.10 | 0.00 | 0.03 | 0.11 | 0.05 | 0.04 | 0.05 | 0.08 |
| Li2O\* | 0.06 | 0.05 | 0.00 | 0.06 | 0.00 | 0.01 | 0.06 | 0.02 | 0.02 | 0.03 | 0.04 |
| H2O\* | 4.41 | 4.41 | 4.52 | 4.41 | 4.52 | 4.46 | 4.35 | 4.40 | 4.44 | 4.44 | 4.38 |
| Total | 100.16 | 99.73 | 99.88 | 100.01 | 99.84 | 99.44 | 99.11 | 98.64 | 99.53 | 99.85 | 99.54 |
|  | 以24个阴离子为基础计算 | | | | | | | | | | |
| Si | 6.15 | 6.17 | 6.19 | 6.22 | 6.18 | 6.16 | 6.12 | 6.06 | 6.10 | 6.13 | 6.12 |
| AlⅣ | 1.85 | 1.83 | 1.81 | 1.78 | 1.82 | 1.84 | 1.88 | 1.94 | 1.90 | 1.87 | 1.88 |
| T-Site | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 |
| AlⅥ | 3.70 | 3.71 | 3.71 | 3.64 | 3.67 | 3.69 | 3.85 | 3.92 | 3.89 | 3.90 | 3.86 |
| Ti | 0.09 | 0.09 | 0.08 | 0.08 | 0.09 | 0.09 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 |
| Fe | 0.16 | 0.15 | 0.16 | 0.18 | 0.17 | 0.16 | 0.17 | 0.14 | 0.14 | 0.14 | 0.18 |
| Mn | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 |
| Mg | 0.12 | 0.12 | 0.12 | 0.14 | 0.14 | 0.10 | 0.02 | 0.02 | 0.02 | 0.00 | 0.03 |
| Li\* | 0.03 | 0.03 | 0.00 | 0.03 | 0.00 | 0.01 | 0.03 | 0.01 | 0.01 | 0.02 | 0.02 |
| Y-Site | 4.10 | 4.10 | 4.07 | 4.08 | 4.08 | 4.06 | 4.09 | 4.09 | 4.06 | 4.05 | 4.09 |
| Ca | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Na | 0.09 | 0.08 | 0.09 | 0.12 | 0.13 | 0.09 | 0.14 | 0.09 | 0.10 | 0.16 | 0.08 |
| K | 1.71 | 1.70 | 1.70 | 1.72 | 1.68 | 1.75 | 1.70 | 1.69 | 1.72 | 1.65 | 1.69 |
| Rb | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.03 | 0.06 | 0.06 | 0.07 | 0.08 |
| Cs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| X-Site | 1.81 | 1.78 | 1.79 | 1.84 | 1.82 | 1.85 | 1.87 | 1.85 | 1.89 | 1.88 | 1.85 |
| F | 0.10 | 0.09 | 0.00 | 0.10 | 0.00 | 0.03 | 0.10 | 0.05 | 0.04 | 0.05 | 0.08 |
| Cl | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| OH\* | 3.90 | 3.91 | 4.00 | 3.90 | 4.00 | 3.97 | 3.89 | 3.95 | 3.96 | 3.95 | 3.92 |
| Z-Site | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |

**续表1**

Continued Table 1

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 白云母-微斜长石伟晶岩 | | | | | 白云母-钠长石-锂辉石伟晶岩 | | | | | | |
| 矿物 | Ms | Ms | Ms | Ms | Ms | Ms | Zwd | Ms | Ms | Ms | Ms | Ms |
| 编号 | DN32-1-1 | DN32-1-2 | DN32-2-7 | DN32-2-8 | DN32-2-9 | DN15-1-1 | DN15-1-4 | DN15-1-5 | DN15-2-1 | DN15-2-2 | DN15-2-3 | DN15-2-5 |
| SiO2 | 45.47 | 45.08 | 45.87 | 45.92 | 45.81 | 46.44 | 52.19 | 46.35 | 46.53 | 46.14 | 45.34 | 46.33 |
| TiO2 | 0.00 | 0.00 | 0.08 | 0.11 | 0.04 | 0.03 | 0.00 | 0.00 | 0.10 | 0.11 | 0.10 | 0.09 |
| Al2O3 | 37.67 | 37.00 | 36.74 | 36.63 | 37.35 | 36.44 | 21.25 | 36.55 | 36.59 | 37.12 | 37.46 | 36.95 |
| FeO | 0.94 | 1.00 | 1.08 | 1.09 | 1.04 | 1.62 | 5.36 | 1.74 | 1.35 | 1.34 | 1.25 | 1.27 |
| MnO | 0.00 | 0.02 | 0.06 | 0.00 | 0.03 | 0.06 | 0.28 | 0.08 | 0.05 | 0.05 | 0.05 | 0.07 |
| MgO | 0.22 | 0.28 | 0.31 | 0.40 | 0.24 | 0.06 | 0.14 | 0.05 | 0.06 | 0.07 | 0.03 | 0.05 |
| CaO | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Na2O | 0.39 | 0.42 | 0.29 | 0.34 | 0.48 | 0.39 | 0.07 | 0.44 | 0.27 | 0.26 | 0.31 | 0.28 |
| K2O | 10.25 | 10.44 | 10.04 | 10.16 | 9.98 | 10.04 | 10.47 | 10.28 | 10.00 | 10.12 | 10.34 | 9.50 |
| Rb2O | 0.09 | 0.11 | 0.00 | 0.11 | 0.14 | 0.42 | 1.07 | 0.41 | 0.41 | 0.45 | 0.44 | 0.49 |
| Cs2O | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| F | 0.00 | 0.00 | 0.11 | 0.11 | 0.14 | 0.27 | 6.17 | 0.18 | 0.09 | bdl | 0.12 | 0.16 |
| Cl | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.04 |
| O=F,Cl | 0.00 | 0.00 | 0.05 | 0.05 | 0.06 | 0.11 | 2.60 | 0.08 | 0.04 | 0.00 | 0.06 | 0.08 |
| Li2O\* | 0.00 | 0.00 | 0.02 | 0.02 | 0.03 | 0.07 | 4.39 | 0.04 | 0.02 | 0.00 | 0.02 | 0.03 |
| H2O\* | 4.51 | 4.47 | 4.44 | 4.45 | 4.46 | 4.39 | 1.51 | 4.44 | 4.48 | 4.53 | 4.44 | 4.43 |
| Total | 99.54 | 98.88 | 99.00 | 99.29 | 99.68 | 99.08 | 98.06 | 99.80 | 99.22 | 99.32 | 97.79 | 100.24 |
|  | 以24个阴离子为基础计算 | | | | | | | | | | | |
| Si | 6.04 | 6.05 | 6.12 | 6.12 | 6.07 | 6.16 | 7.05 | 6.14 | 6.17 | 6.11 | 6.04 | 6.14 |
| AlⅣ | 1.96 | 1.95 | 1.88 | 1.88 | 1.93 | 1.84 | 0.95 | 1.86 | 1.83 | 1.89 | 1.96 | 1.86 |
| T-Site | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 |
| AlⅥ | 3.94 | 3.90 | 3.89 | 3.87 | 3.91 | 3.85 | 2.44 | 3.84 | 3.88 | 3.90 | 3.91 | 3.92 |
| Ti | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 |
| Fe | 0.10 | 0.11 | 0.12 | 0.12 | 0.12 | 0.18 | 0.61 | 0.19 | 0.15 | 0.15 | 0.14 | 0.14 |
| Mn | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.03 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Mg | 0.04 | 0.06 | 0.06 | 0.08 | 0.05 | 0.01 | 0.03 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Li\* | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 | 0.04 | 2.39 | 0.02 | 0.01 | 0.00 | 0.01 | 0.02 |
| Y-Site | 4.09 | 4.07 | 4.10 | 4.09 | 4.10 | 4.09 | 5.49 | 4.08 | 4.07 | 4.08 | 4.08 | 4.11 |
| Ca | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Na | 0.10 | 0.11 | 0.07 | 0.09 | 0.12 | 0.10 | 0.02 | 0.11 | 0.07 | 0.07 | 0.08 | 0.07 |
| K | 1.74 | 1.79 | 1.71 | 1.73 | 1.69 | 1.70 | 1.80 | 1.74 | 1.69 | 1.71 | 1.76 | 1.61 |
| Rb | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 | 0.04 | 0.09 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 |
| Cs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| X-Site | 1.85 | 1.91 | 1.78 | 1.82 | 1.82 | 1.84 | 1.92 | 1.88 | 1.80 | 1.81 | 1.87 | 1.72 |
| F | 0.00 | 0.00 | 0.05 | 0.05 | 0.06 | 0.11 | 2.64 | 0.08 | 0.04 | 0.00 | 0.05 | 0.07 |
| Cl | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| OH\* | 4.00 | 4.00 | 3.95 | 3.95 | 3.94 | 3.89 | 1.36 | 3.92 | 3.96 | 4.00 | 3.94 | 3.92 |
| Z-Site | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |

**续表1**

Continued Table 1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 白云母-钠长石-锂辉石伟晶岩 | | | | | | | | | | | | |
| 矿物 | Zwd | Lpd | Zwd | Lpd | Lpd | Ms | Ms | Li-phg | Ms | Ms | Ms | Ms | Ms |
| 编号 | DN15-1-3 | AK3-1-7 | AK3-1-11 | AK3-1-8 | AK3-1-9 | AK3-2-5 | DN13-1-2 | DN13-1-3 | DN13-2-1 | DN13-2-2 | DN13-3-1 | DN13-3-5 | DN13-3-7 |
| SiO2 | 52.03 | 52.81 | 52.27 | 52.38 | 52.87 | 45.72 | 46.58 | 49.48 | 46.03 | 46.32 | 45.60 | 45.39 | 49.12 |
| TiO2 | 0.00 | 0.05 | 0.02 | 0.04 | 0.02 | 0.00 | 0.07 | 0.05 | 0.09 | 0.06 | 0.03 | 0.07 | 0.06 |
| Al2O3 | 23.39 | 21.08 | 21.19 | 21.53 | 21.85 | 37.56 | 35.33 | 26.46 | 37.28 | 35.88 | 37.23 | 36.07 | 32.39 |
| FeO | 3.65 | 3.83 | 4.57 | 4.21 | 3.64 | 0.83 | 1.17 | 3.99 | 0.86 | 1.07 | 0.90 | 0.81 | 2.72 |
| MnO | 0.25 | 0.28 | 0.41 | 0.26 | 0.16 | 0.00 | 0.03 | 0.18 | 0.04 | 0.04 | 0.03 | 0.02 | 0.09 |
| MgO | 0.04 | 0.06 | 0.06 | 0.04 | 0.07 | 0.12 | 0.03 | 0.09 | 0.03 | 0.03 | 0.00 | 0.03 | 0.04 |
| CaO | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Na2O | 0.11 | 0.06 | 0.03 | 0.09 | 0.09 | 0.39 | 0.12 | 0.06 | 0.53 | 0.20 | 0.30 | 0.50 | 0.10 |
| K2O | 10.53 | 10.57 | 10.40 | 10.57 | 10.68 | 10.00 | 10.61 | 10.15 | 9.82 | 10.48 | 10.22 | 10.01 | 10.07 |
| Rb2O | 1.13 | 1.28 | 1.32 | 1.26 | 1.20 | 0.61 | 0.51 | 0.90 | 0.53 | 0.54 | 0.52 | 0.43 | 0.62 |
| Cs2O | 0.11 | 0.13 | 0.12 | 0.17 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| F | 5.60 | 6.45 | 6.15 | 6.47 | 6.30 | 0.00 | 0.40 | 3.36 | 0.20 | 0.33 | 0.00 | 0.11 | 1.04 |
| Cl | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| O=F,Cl | 2.36 | 2.72 | 2.59 | 2.72 | 2.65 | 0.00 | 0.17 | 1.41 | 0.08 | 0.14 | 0.00 | 0.05 | 0.44 |
| Li2O\* | 3.86 | 4.66 | 4.38 | 4.68 | 4.52 | 0.00 | 0.12 | 1.96 | 0.05 | 0.09 | 0.00 | 0.02 | 0.41 |
| H2O\* | 1.81 | 1.39 | 1.51 | 1.39 | 1.49 | 4.52 | 4.28 | 2.77 | 4.43 | 4.32 | 4.49 | 4.38 | 4.02 |
| Total | 100.15 | 99.95 | 99.84 | 100.36 | 100.34 | 99.75 | 99.08 | 98.06 | 99.80 | 99.22 | 99.32 | 97.79 | 100.24 |
|  | 以24个阴离子为基础计算 | | | | | | | | | | | | |
| Si | 6.99 | 7.12 | 7.09 | 7.05 | 7.09 | 6.07 | 6.25 | 6.79 | 6.10 | 6.20 | 6.09 | 6.15 | 6.53 |
| AlⅣ | 1.01 | 0.88 | 0.91 | 0.95 | 0.91 | 1.93 | 1.75 | 1.21 | 1.90 | 1.80 | 1.91 | 1.85 | 1.47 |
| T-Site | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 |
| AlⅥ | 2.70 | 2.47 | 2.48 | 2.47 | 2.54 | 3.95 | 3.83 | 3.08 | 3.93 | 3.86 | 3.94 | 3.91 | 3.60 |
| Ti | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 |
| Fe | 0.41 | 0.43 | 0.52 | 0.47 | 0.41 | 0.09 | 0.13 | 0.46 | 0.10 | 0.12 | 0.10 | 0.09 | 0.30 |
| Mn | 0.03 | 0.03 | 0.05 | 0.03 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Mg | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 |
| Li\* | 2.09 | 2.53 | 2.39 | 2.53 | 2.44 | 0.00 | 0.06 | 1.08 | 0.03 | 0.05 | 0.00 | 0.01 | 0.22 |
| Y-Site | 5.23 | 5.48 | 5.45 | 5.52 | 5.42 | 4.07 | 4.04 | 4.66 | 4.07 | 4.04 | 4.05 | 4.02 | 4.15 |
| Ca | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Na | 0.03 | 0.02 | 0.01 | 0.02 | 0.02 | 0.10 | 0.03 | 0.02 | 0.14 | 0.05 | 0.08 | 0.13 | 0.03 |
| K | 1.80 | 1.82 | 1.80 | 1.82 | 1.83 | 1.69 | 1.81 | 1.78 | 1.66 | 1.79 | 1.74 | 1.73 | 1.71 |
| Rb | 0.10 | 0.11 | 0.12 | 0.11 | 0.10 | 0.05 | 0.04 | 0.08 | 0.05 | 0.05 | 0.04 | 0.04 | 0.05 |
| Cs | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| X-Site | 1.94 | 1.96 | 1.93 | 1.96 | 1.96 | 1.85 | 1.89 | 1.88 | 1.84 | 1.89 | 1.86 | 1.90 | 1.79 |
| F | 2.38 | 2.75 | 2.64 | 2.76 | 2.67 | 0.00 | 0.17 | 1.46 | 0.08 | 0.14 | 0.00 | 0.05 | 0.44 |
| Cl | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| OH\* | 1.62 | 1.25 | 1.36 | 1.24 | 1.33 | 4.00 | 3.83 | 2.54 | 3.92 | 3.86 | 4.00 | 3.95 | 3.56 |
| Z-Site | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |

注：Ms-白云母；Li-Phg-富锂多硅白云母；Zwd-铁锂云母；Lpd-锂云母；带\*的元素含量根据相关计算得到。

**表2 大红柳滩地区二云母花岗岩及不同矿化程度伟晶岩中电气石主量元素数据（wt.%）**

Table 2. Major element data of tourmaline from two-mica granite and pegmatite in the Dahongliutan area (wt.%)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 二云母花岗岩 | | | | | | | | | | | |
| 矿物 | Schorl | Schorl | Schorl | Schorl | Schorl | Schorl | Schorl | Schorl | Schorl | Schorl | Schorl | Schorl |
| 编号 | DN35-3-1 | DN35-3-2 | DN35-3-3 | DN35-3-4 | DN35-4-11 | DN35-4-10 | DN35-4-9 | DN35-4-8 | DN35-5-1 | DN35-5-2 | DN35-5-3 | DN35-5-4 |
| SiO2 | 34.81 | 35.42 | 35.38 | 34.69 | 34.79 | 35.33 | 35.35 | 35.52 | 35.32 | 34.96 | 35.23 | 35.11 |
| TiO2 | 0.82 | 0.88 | 0.76 | 0.91 | 0.84 | 0.88 | 0.69 | 0.62 | 0.56 | 0.70 | 0.74 | 0.78 |
| Al2O3 | 33.57 | 33.66 | 33.22 | 33.70 | 34.02 | 33.64 | 32.92 | 33.71 | 33.18 | 33.17 | 33.43 | 33.13 |
| V2O3 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 |
| FeO | 9.44 | 9.72 | 9.42 | 9.20 | 9.33 | 9.31 | 9.33 | 9.32 | 9.25 | 9.32 | 9.51 | 9.33 |
| MgO | 4.21 | 4.43 | 4.46 | 4.22 | 4.34 | 4.42 | 4.46 | 4.66 | 4.59 | 4.61 | 4.62 | 4.45 |
| CaO | 0.24 | 0.26 | 0.29 | 0.30 | 0.28 | 0.27 | 0.26 | 0.29 | 0.27 | 0.29 | 0.25 | 0.24 |
| MnO | 0.11 | 0.13 | 0.11 | 0.11 | 0.09 | 0.10 | 0.11 | 0.14 | 0.10 | 0.10 | 0.09 | 0.08 |
| Na2O | 2.07 | 2.11 | 2.19 | 2.18 | 2.27 | 2.20 | 2.11 | 2.02 | 2.18 | 2.24 | 2.11 | 2.26 |
| K2O | 0.04 | 0.05 | 0.03 | 0.03 | 0.05 | 0.03 | 0.06 | 0.04 | 0.02 | 0.06 | 0.06 | 0.03 |
| F | 0.00 | 0.19 | 0.11 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.15 | 0.12 | 0.19 | 0.00 |
| H2O\* | 3.60 | 3.56 | 3.58 | 3.61 | 3.63 | 3.64 | 3.53 | 3.65 | 3.54 | 3.55 | 3.54 | 3.61 |
| B2O3\* | 10.44 | 10.59 | 10.51 | 10.46 | 10.53 | 10.56 | 10.45 | 10.57 | 10.48 | 10.45 | 10.52 | 10.46 |
| Li2O\* | 0.21 | 0.20 | 0.25 | 0.27 | 0.24 | 0.26 | 0.25 | 0.17 | 0.22 | 0.21 | 0.17 | 0.26 |
| O=F | 0.00 | 0.08 | 0.05 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.06 | 0.05 | 0.08 | 0.00 |
| Total\* | 99.57 | 101.12 | 100.27 | 99.70 | 100.44 | 100.65 | 99.64 | 100.72 | 99.80 | 99.73 | 100.40 | 99.73 |
|  | 基于31个氧原子计算 | | | | | | | | | | | |
| T: Si | 5.80 | 5.81 | 5.85 | 5.77 | 5.74 | 5.81 | 5.88 | 5.84 | 5.86 | 5.81 | 5.82 | 5.83 |
| Al | 0.21 | 0.19 | 0.15 | 0.24 | 0.26 | 0.19 | 0.12 | 0.16 | 0.14 | 0.19 | 0.18 | 0.17 |
| B | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Z: Al | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 |
| Mg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fe3+ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Y: Al | 0.38 | 0.33 | 0.32 | 0.37 | 0.37 | 0.34 | 0.33 | 0.37 | 0.35 | 0.32 | 0.33 | 0.32 |
| Ti | 0.10 | 0.11 | 0.09 | 0.11 | 0.10 | 0.11 | 0.09 | 0.08 | 0.07 | 0.09 | 0.09 | 0.10 |
| V | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fe3+ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mg | 1.05 | 1.08 | 1.10 | 1.05 | 1.07 | 1.08 | 1.11 | 1.14 | 1.14 | 1.14 | 1.14 | 1.10 |
| Mn | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 |
| Fe2+ | 1.31 | 1.33 | 1.30 | 1.28 | 1.29 | 1.28 | 1.30 | 1.28 | 1.28 | 1.30 | 1.31 | 1.30 |
| Li\* | 0.14 | 0.13 | 0.17 | 0.18 | 0.16 | 0.17 | 0.17 | 0.11 | 0.15 | 0.14 | 0.11 | 0.17 |
| ΣY | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| X: Ca | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.04 | 0.04 |
| Na | 0.67 | 0.67 | 0.70 | 0.70 | 0.73 | 0.70 | 0.68 | 0.64 | 0.70 | 0.72 | 0.68 | 0.73 |
| K | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 |
| X□ | 0.28 | 0.27 | 0.24 | 0.24 | 0.21 | 0.24 | 0.26 | 0.30 | 0.25 | 0.21 | 0.27 | 0.22 |
| OH | 4.00 | 3.90 | 3.94 | 4.00 | 4.00 | 4.00 | 3.92 | 4.00 | 3.92 | 3.94 | 3.90 | 4.00 |

**续表2**

Continued Table 2

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 白云母-微斜长石伟晶岩 | | | | | 白云母-钠长石-锂辉石伟晶岩 | | | | | | | |
| 矿物 | Schorl | Schorl | Schorl | Schorl | Schorl | Elbaite | Elbaite | Elbaite | Elbaite | Elbaite | Elbaite | Elbaite | Elbaite |
| 编号 | DN5-3-1 | DN5-3-2 | DN5-3-7 | DN5-4-5 | DN5-4-6 | AK3-2 | AK3-3 | AK4-5 | AK4-6 | AK4-9 | AK5-11 | AK5-12 | AK5-13 |
| SiO2 | 34.65 | 33.68 | 34.35 | 33.82 | 33.60 | 35.63 | 34.82 | 34.79 | 35.11 | 35.47 | 35.27 | 35.56 | 35.72 |
| TiO2 | 0.21 | 0.23 | 0.16 | 0.23 | 0.25 | 0.17 | 0.16 | 0.11 | 0.13 | 0.13 | 0.17 | 0.24 | 0.19 |
| Al2O3 | 35.51 | 36.44 | 36.36 | 36.15 | 36.80 | 36.65 | 36.91 | 37.17 | 37.10 | 37.05 | 37.40 | 36.85 | 37.47 |
| V2O3 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.02 |
| FeO | 11.36 | 11.43 | 11.67 | 11.58 | 11.77 | 8.11 | 8.25 | 7.66 | 7.82 | 8.22 | 8.11 | 8.38 | 8.49 |
| MgO | 0.43 | 0.40 | 0.47 | 0.43 | 0.47 | 0.04 | 0.04 | 0.05 | 0.05 | 0.02 | 0.02 | 0.04 | 0.03 |
| CaO | 0.12 | 0.12 | 0.08 | 0.06 | 0.13 | 0.07 | 0.12 | 0.10 | 0.10 | 0.09 | 0.11 | 0.09 | 0.06 |
| MnO | 0.21 | 0.29 | 0.24 | 0.24 | 0.25 | 0.29 | 0.32 | 0.29 | 0.33 | 0.35 | 0.37 | 0.31 | 0.34 |
| Na2O | 2.13 | 2.18 | 1.89 | 2.05 | 2.04 | 2.60 | 2.60 | 2.72 | 2.58 | 2.65 | 2.58 | 2.69 | 2.57 |
| K2O | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | 0.05 | 0.06 | 0.04 | 0.00 | 0.00 | 0.02 | 0.02 | 0.02 |
| F | 0.42 | 0.34 | 0.36 | 0.26 | 0.39 | 0.93 | 0.91 | 0.90 | 0.95 | 0.77 | 0.96 | 0.92 | 1.02 |
| H2O\* | 3.38 | 3.41 | 3.42 | 3.44 | 3.40 | 3.20 | 3.17 | 3.18 | 3.17 | 3.28 | 3.19 | 3.21 | 3.19 |
| B2O3\* | 10.37 | 10.35 | 10.41 | 10.32 | 10.38 | 10.55 | 10.45 | 10.46 | 10.49 | 10.56 | 10.57 | 10.58 | 10.66 |
| Li2O\* | 0.63 | 0.52 | 0.46 | 0.48 | 0.42 | 1.20 | 1.12 | 1.20 | 1.17 | 1.17 | 1.15 | 1.18 | 1.12 |
| O=F | 0.18 | 0.14 | 0.15 | 0.11 | 0.16 | 0.39 | 0.38 | 0.38 | 0.40 | 0.32 | 0.40 | 0.39 | 0.43 |
| Total\* | 99.28 | 99.30 | 99.75 | 98.98 | 99.77 | 99.29 | 98.56 | 98.31 | 98.60 | 99.43 | 99.51 | 99.72 | 100.48 |
|  | 基于31个氧原子计算 | | | | | | | | | | | | |
| T: Si | 5.81 | 5.66 | 5.74 | 5.70 | 5.62 | 5.87 | 5.79 | 5.78 | 5.82 | 5.84 | 5.80 | 5.84 | 5.83 |
| Al | 0.19 | 0.34 | 0.27 | 0.30 | 0.38 | 0.13 | 0.21 | 0.22 | 0.18 | 0.16 | 0.20 | 0.16 | 0.18 |
| B | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Z: Al | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 |
| Mg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fe3+ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Y: Al | 0.82 | 0.87 | 0.89 | 0.87 | 0.88 | 0.99 | 1.03 | 1.07 | 1.06 | 1.03 | 1.05 | 0.98 | 1.03 |
| Ti | 0.03 | 0.03 | 0.02 | 0.03 | 0.03 | 0.02 | 0.02 | 0.01 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 |
| V | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Fe3+ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mg | 0.11 | 0.10 | 0.12 | 0.11 | 0.12 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Mn | 0.03 | 0.04 | 0.03 | 0.03 | 0.04 | 0.04 | 0.05 | 0.04 | 0.05 | 0.05 | 0.05 | 0.04 | 0.05 |
| Fe2+ | 1.59 | 1.61 | 1.63 | 1.63 | 1.65 | 1.12 | 1.15 | 1.07 | 1.08 | 1.13 | 1.12 | 1.15 | 1.16 |
| Li\* | 0.42 | 0.35 | 0.31 | 0.33 | 0.29 | 0.80 | 0.75 | 0.80 | 0.78 | 0.77 | 0.76 | 0.78 | 0.74 |
| ΣY | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| X: Ca | 0.02 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 |
| Na | 0.69 | 0.71 | 0.61 | 0.67 | 0.66 | 0.83 | 0.84 | 0.88 | 0.83 | 0.85 | 0.82 | 0.86 | 0.81 |
| K | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| X□ | 0.28 | 0.26 | 0.37 | 0.31 | 0.31 | 0.15 | 0.13 | 0.10 | 0.15 | 0.14 | 0.15 | 0.12 | 0.17 |
| OH | 3.78 | 3.82 | 3.81 | 3.86 | 3.79 | 3.52 | 3.52 | 3.53 | 3.50 | 3.60 | 3.50 | 3.52 | 3.47 |

注：Schorl-黑电气石；Elbaite-锂电气石；根据XY3Z6T6O18(BO3)3V3W的晶体结构式计算H2O、B2O3和Li2O的值(据Henry and Guidotti, 1985)。