

Table 16. Calculated compositions of liquid fractionates and crystalline residua derived from the high-alumina olivine tholeiite composition at 27 kb

| Temperature  |                    | 1,435° C | 1,430° C          | 1,400° C                       |
|--|--------------------|----------|-------------------|--------------------------------|
| Nature and estimated % of crystals                               | Initial<br>litquid | 5% cpx   | 8% cpx<br>2% ga   | 25% cpx <sup>b</sup><br>10% ga |
| <i>Liquid fractionate</i>  |                    |          |                   |                                |
| SiO <sub>2</sub>   | 50.3               | 50.4     | 50.6 <sup>a</sup> | 52.0 <sup>a</sup>              |
| TiO <sub>2</sub>   | 1.7                | 1.8      | 1.8               | 2.0                            |
| Al <sub>2</sub> O <sub>3</sub>                                   | 17.0               | 17.3     | 17.2              | 17.1                           |
| Fe <sub>2</sub> O <sub>3</sub>                                   | 1.5                | 1.6      | 1.7               | 2.3                            |
| FeO  | 7.6                | 7.8      | 7.8               | 6.9                            |
| MnO  | 0.16               | 0.17     | 0.17              | 0.18                           |
| MgO  | 7.8                | 7.5      | 7.1               | 6.1                            |
| CaO  | 11.4               | 11.2     | 11.1              | 10.5                           |
| Na <sub>2</sub> O  | 2.8                | 2.8      | 2.9               | 3.3                            |
| K <sub>2</sub> O   | 0.18               | 0.2      | 0.2               | 0.28                           |
|  | 100.4              | 100.8    | 100.6             | 100.7                          |
| Mol. Prop.   |                    |          |                   |                                |
| $\frac{100 \text{ MgO}}{\text{MgO} + \text{FeO}_{\text{Total}}}$ | 60.7               | 59.2     | 57.7              | 54.7                           |
| <i>CIPW norm</i>   |                    |          |                   |                                |
| Qz   | —                  | —        | —                 | 1.1                            |
| Or   | 1.1                | 1.2      | 1.2               | 1.7                            |
| Ab   | 23.7               | 23.7     | 24.6              | 27.9                           |
| An   | 33.3               | 34.1     | 33.3              | 31.0                           |
| Diop   | 18.9               | 17.5     | 17.7              | 17.1                           |
| Hyp  | 11.9               | 13.6     | 14.2              | 14.7                           |
| Ol   | 6.2                | 5.0      | 3.7               | —                              |
| Mt   | 2.2                | 2.4      | 2.5               | 3.3                            |
| Ilm  | 3.2                | 3.4      | 3.4               | 3.8                            |
| <i>Crystal residuum</i>  |                    |          |                   |                                |
| SiO <sub>2</sub>   |                    | 48.0     | 48.0              | 47.2                           |
| TiO <sub>2</sub>   |                    | 0.5      | 0.6               | 1.1                            |
| Al <sub>2</sub> O <sub>3</sub>                                   |                    | 12.2     | 15.1              | 16.8                           |
| FeO  |                    | 4.4      | 5.9               | 8.9                            |
| MnO  |                    | —        | 0.04              | 0.1                            |
| MgO  |                    | 14.0     | 14.6              | 11.0                           |
| CaO  |                    | 15.7     | 14.1              | 13.0                           |
| Na <sub>2</sub> O  |                    | 1.9      | 1.7               | 1.8                            |
| K <sub>2</sub> O   |                    | —        | —                 | —                              |
|  |                    | 96.7     | 100.0             | 99.9                           |
| Mol. prop.   |                    |          |                   |                                |
| $\frac{100 \text{ MgO}}{\text{MgO} + \text{FeO}}$                |                    | 85.0     | 81.5              | 68.8                           |

<sup>a</sup> Denotes compositions determined from analyses calculated in the manner described on p. 116.

<sup>b</sup> This pyroxene could not be analyzed and is assumed to be similar in composition to the pyroxene crystallizing from the high-alumina quartz tholeiite at 27 kb, 1,385° C; the degree of crystallization is similar for this temperature.

Table 17. *Calculated compositions of liquid fractionates and crystalline residua derived from the high-alumina quartz tholeiite composition at 27 kb*

| Temperature                        | 1,420° C       | 1,400° C        | 1,385° C           |                   |
|------------------------------------|----------------|-----------------|--------------------|-------------------|
| Nature and estimated % of crystals | Initial liquid | 5% cpx<br>1% ga | 15% cpx<br>5% ga   | 25% cpx<br>10% ga |
| <i>Liquid fractionate</i>          |                |                 |                    |                   |
| SiO <sub>2</sub>                   | 52.9           | 53.2            | 54.2               | 56.0              |
| TiO <sub>2</sub>                   | 1.5            | 1.5             | 1.5                | 1.6               |
| Al <sub>2</sub> O <sub>3</sub>     | 16.9           | 17.0            | 17.3               | 17.0              |
| Fe <sub>2</sub> O <sub>3</sub>     | 0.3            | 0.3             | 0.4                | 0.5               |
| FeO                                | 7.9            | 8.0             | 7.8                | 7.3               |
| MnO                                | 0.2            | 0.2             | 0.2                | 0.2               |
| MgO                                | 7.0            | 6.7             | 6.0                | 5.3               |
| CaO                                | 10.0           | 9.7             | 9.1                | 8.5               |
| Na <sub>2</sub> O                  | 2.7            | 2.8             | 2.9                | 3.4               |
| K <sub>2</sub> O                   | 0.6            | 0.6             | 0.7 <sub>5</sub>   | 0.9               |
|                                    | 100.0          | 100.0           | 100.1 <sub>5</sub> | 100.7             |
| Mol. prop.                         |                |                 |                    |                   |
| 100 MgO                            |                |                 |                    |                   |
| MgO + FeO <sub>Total</sub>         | 60.4           | 59.1            | 56.7               | 54.9              |
| <i>CIPW norm</i>                   |                |                 |                    |                   |
| Qz                                 | 1.3            | 1.7             | 3.4                | 4.7               |
| Or                                 | 3.5            | 3.6             | 4.5                | 5.4               |
| Ab                                 | 22.8           | 23.7            | 24.6               | 28.8              |
| An                                 | 32.2           | 32.0            | 31.9               | 28.4              |
| Diop                               | 14.2           | 13.1            | 10.9               | 11.3              |
| Hyp                                | 22.6           | 22.5            | 21.5               | 18.4              |
| Ol                                 | —              | —               | —                  | —                 |
| Mt                                 | 0.4            | 0.4             | 0.6                | 0.7               |
| Ilm                                | 2.8            | 2.9             | 2.9                | 3.0               |
| <i>Crystal residuum</i>            |                |                 |                    |                   |
| SiO <sub>2</sub>                   |                | 47.9            | 47.6               | 47.3              |
| TiO <sub>2</sub>                   |                | 1.1             | 1.4                | 1.3               |
| Al <sub>2</sub> O <sub>3</sub>     |                | 14.7            | 15.5               | 16.7              |
| FeO                                |                | 7.0             | 8.3                | 9.0               |
| MnO                                |                | 0.1             | 0.1                | 0.1               |
| MgO                                |                | 12.3            | 11.2               | 10.1              |
| CaO                                |                | 14.1            | 13.5               | 12.8              |
| Na <sub>2</sub> O                  |                | 1.8             | 1.7                | 1.7               |
| K <sub>2</sub> O                   |                | —               | —                  | —                 |
|                                    |                | 99.0            | 99.1               | 99.0              |
| Mol. prop.                         |                |                 |                    |                   |
| 100 MgO                            |                |                 |                    |                   |
| MgO + FeO                          |                | 75.8            | 70.6               | 66.7              |

The fractionation trends are illustrated diagrammatically by plotting on the familiar FMA diagram, frequently used to demonstrate fractionation trends of the calc-alkaline series (Figs. 9—11). The trend in fractionation observed at